CIRCULATES IN EVERY PROVINCE OF CANADA AND ABROAD

MARINE ENGINEERING of Canada

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Canadian Shipping and Shipbuilding During 1916

Contributed and Compiled

Embracing statistics of shipments of a variety of commodities, port and canal tonnages, wrecks and loss of life; vessels built and building within the Dominion during 1916, *together with their tonnage, horse power, and service; waterway improvements, etc.*

WELLAND SHIP CANAL

By J. L. Weller.*

CONSTRUCTION operations on the Welland Ship Canal have progressed steadily during the present year. The increasing shortage of labor has, however, been seriously felt by the different contractors, with the result that some portions of the work have had to be curtailed and the available labor largely concentrated on prism excavation and concreting in the locks. The work under contract at present is the same as last year, namely, Sections No. 1, 2, 3 and 5.

Section No. 1

The building of the harbor embankments, which will form the new Lake Ontario entrance to the canal, has been carried on continuously during the year, and approximately 5,500,000 cubic yards of the 8,000,000 cubic yards of material available for this purpose have been placed. The end of the west embankment has now reached the outer extremity of the harbor, and the east embankment is within a few hundred feet of the outer end. The balance of the material available will be used to widen out the embankments. Eighteen of the reinforced concrete cribs which will form the foundation for the outer entrance piers, and docking in the inner harbor, have been placed in position. Dredging in the channel has been carried on by three large dipper dredges, the dredged material being dumped to help form the harbor embankments.

Very good progress has been made on the construction of Lock No. 1, which is located just inside the shore line. The lock walls will be 82 ft. in height. A portion of the west wall of Lock No. 1, which includes the stairway from the lower to the upper level, recesses for the guard gates and single leaf gate, outlet valve chambers, etc., has been completed to coping level. The remainder of the wall is up to the elevation of the mooring chamber, 29 ft. below coping. The east wall is not quite as far advanced, being practically at the elevation of the mooring chamber over its entire length.

The long reinforced concrete retaining wall on the west side, extending from the foot of Lock No. 1 to the shore line, is complete with the exception of a short section where the contractor's concrete mixing plant is located. No dry excavation has been carried on during the year on this section, as the only remaining material to be excavated is being reserved for back-filling behind the lock walls.

Section No. 2

Work on this section has been almost entirely confined to the excavation of the canal prism and the construction of Lock No. 2. Prism excavation has been carried on by four steam shovels and three dragline excavators, the material being hauled to Lake Ontario and deposited in the harbor embankments. For a distance of 8,000 ft. above Lock No. 2, the canal is in fill, and the east bank is being built well around to the east side; in this way a large regulating pondage is being formed at the head of the lock. The construction of the canal banks is being carried on by an outfit of grading machines, and the embankments to form this pondage are now rapidly nearing completion.

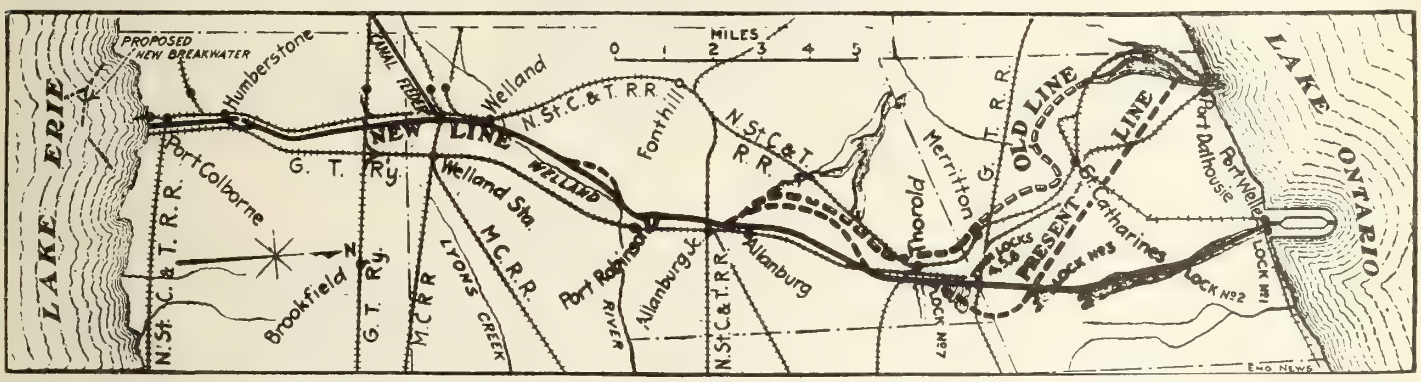
The upper entrance walls to Lock No. 2 are practically complete, and the side walls of the lock have been under construction during the past year. These walls are built in 60-ft. monoliths, and the different monoliths in both the east and west walls are in various stages of advancement. The average height of the west wall is now 46 ft. above the lock floor, and in the east wall the foundation is complete to mitre still level. Considerable concreting has been done in four monoliths above this level. A small amount of work has also been done in the construction of the lower west entrance wall to the lock.

Excavation on the north half of the section is complete to grade, but a large amount of material has still to be removed from the south half. Very little work has been done this year at the site of Lock No. 3, beyond the excavation of the lock pit, as the contractors have concentrated their efforts on the building of Lock No. 2. The embankments which will form the regulating pond at the head of this lock are well advanced toward completion. A good deal of work has been done on the construction of the concrete protection to banks at the water line along the canal reaches on this section.

Section No. 3

Operations on this section have consisted almost entirely of earth and rock excavation, practically no concrete having been placed during the year. The pits for Locks 5 and 6 have been excavated to grade, and are now ready for concrete, with the exception of the cleaning up of the foundations. The earth overlying the rock on the site of Twin Locks No. 4 has been removed, and approximately 40 ft. of rock remains to be excavated before grade of the locks is reached. About the same depth of rock has still to be removed in the reach between Twin Locks No. 6 and the head of Single Lock No. 7.

The good rock from the excavation has been sent to the large crushing plant at the north end of the section, and furnished as concrete aggregate to sections No. 1 and 2. The inferior rock has been utilized as filling on low land on the east side of the flight locks. A washing



DIAGRAMMATIC REPRESENTATION OF ROUTE OF NEW WELLAND SHIP CANAL.

*Engineer in charge.

plant has been constructed in connection with the rock crusher, and all stone requiring it is thoroughly washed before being used for concrete.

The earth excavated from the north end of the section has been sent to Lake Ontario and deposited in the harbor embankments, while that from the south end has been taken to the site of the high dam at the head of the flight locks, and is rehandled into the dam by two excavating machines. This dam has now reached the required elevation over a considerable part of its length. The contractors have erected their concreting plant at the head of Twin Locks No. 6, and, if conditions are favorable, it is expected that good progress will be made on concreting in Locks 5 and 6 during 1917. A small amount of work was done in building the long upper entrance wall between the head of Lock No. 7 and the guard gates.

Section No. 5

This section consists of deepening and widening the present canal on the west side, between Allanburg and Port Robinson. Four dredges have been employed in deepening the channel, and a number of steam shovels excavating dry material along the west bank. The dry excavation has now been completed. The dredged material is dumped in a basin cut in the canal bank and pumped by a 20-in. hydraulic dredge into pondages formed on the west side of the canal.

Bridges

The concrete substructures for several bridges over the canal have been completed, but contracts for the bridge superstructures have not yet been awarded.

General Data

The distance from Lake Erie to Lake Ontario by way of the Welland Ship Canal is 25 miles.

Lake Erie is 326 ft. higher than Lake Ontario, and this difference in level will be overcome by seven lift locks, each lock raising or lowering a vessel a distance of 46½ ft.

The present canal has 25 lift locks of only 12 to 14 ft. lift.

The dimensions of the locks of the Welland Ship Canal will be:

800 ft. long in the clear, 80 ft. wide, and 30 ft. depth of water.

The locks on the present canal are:—270 ft. long, 45 ft. wide, and 14 ft. depth of water.

Locks Nos. 1, 2, 3 and 7 will be single locks, while Locks Nos. 4, 5 and 6, ascending the escarpment at Thorold. will be double locks in flight—that is, each pair rising one above the other.

The dimensions of the canal between locks and on the long level between Thorold and Lake Erie, will be:—200 ft. wide at the bottom, 310 ft. wide at the water line, and 25 ft. depth of water.

The largest vessel sailing the lakes today is 625 ft. long, with 59 ft. beam, and as navigation of the channels connecting the Upper Lakes does not at present permit of a greater draught than 20 ft., it is considered that the capacity of the Welland Ship Canal, when completed, will be ample for a great many years to come.

When greater depth is required, it can be obtained by dredging out the canal to 30 ft. in depth, as the locks and other structures are now being built to afford that depth of water.

Total quantity of earth to be excavated:—40,000,000 cubic yards; of rock, 6,000,000 cubic yards.

If all this material were loaded on dump cars, of the kind which may be seen passing along the construction railway parallel with the canal, it would require a train of such cars 15,000 miles long, extending half-way around the globe, to hold it.

Total quantity of concrete to be placed:—2,200,000 cubic yards.

This amount of concrete would build a solid wall 20 ft. high, 6 ft. wide, and 100 miles long.

The lock gates will be of the single-leaf type, extending clear across the chamber, instead of double gates meeting at the centre, as on the present canal. The lower gates will be 82 ft. high, 88 ft. long and 10 ft. thick, built of structural steel, and weighing 1,150 tons. The upper gates, which will rest on top of the "breast wall," will be 37 ft. high, 88 ft. long, and 10 ft. thick.

The time required to pass a vessel through one of the Ship Canal locks will be about 20 minutes. The actual raising or lowering of the vessel in the lock will require but eight minutes.

The estimated time of passing a loaded freight vessel through the entire canal, from lake to lake, is eight hours, as against 15 to 18 hours on the present canal.

When traffic is heavy, or becomes congested for any reason, several vessels of present canal size can be passed through the Ship Canal locks at one lockage.

The estimated cost of the canal is $50,000,000.

Location Features

The Welland Ship Canal is being built on a new location from Lake Ontario to Allanburg, a distance of 12 miles; and from Allanburg to Lake Erie the course of the present canal is, more or less, followed. Whereas all the previous canals have had their Lake Ontario entrance at Port Dalhousie t,he entrance to the Ship Canal is located at Port Weller, three miles east of Port Dalhousie, where a new harbor of most commodious proportions is being constructed.

From Lake Ontario, the canal follows the course of the Ten-mile Creek, crossing the present canal twice, until Allanburg is reached. Here the present canal is entered, and utilized as far as Port Robinson, a distance of about three miles, this stretch being known as the "Deep Cut." At Port Robinson the canal enters the Welland River, which will be raised 6 ft. to canal level, by means of a dam and regulating weir at Port Robinson. This raising of the river will flood about 1,600 acres of low land between Port Robinson and the head of the river, west of Wellandport. From Port Robinson, the canal will follow the Welland River to the Town of Welland. At Welland, the present canal is again entered, and followed through to Port Colborne, on Lake Erie, with the exception of about 1½ miles, at a point known as Ramey's Bend, just this side of Port Colborne, where a very pronounced (S) curve occurs in the existing canal. Here the Ship Canal takes a straight course through a heavy rock cutting, resulting in some saving in distance and contributing toward greater ease of navigation.

Lake Erie Entrance

It is proposed to maintain the long level between Thorold and Port Colborne at elevation 568, which is extreme low water level in Lake Erie; consequently, vessels, except during periods of extreme low water, will have to lock up from the long level a few feet into Lake Erie at the Guard Lock, which is to be built in the rock cutting at Ramey's Bend, just north of the Village of Humberstone.

The present Lake Erie entrance at Port Colborne will be utilized for the Ship Canal. The harbor will not require to be deepened at present, as it already has a depth of 22 ft.; but the present breakwater will be extended about 2,000 ft. out into the lake in order to deaden the swells which now cause some disturbance, at times, to vessels lying at the elevator docks. Where the Ship Canal follows the course of the present canal, the latter will be deepened and widened on the west side, to the enlarged dimensions.

The Welland Ship Canal construction railway, which commences at the shore line of Lake Ontario, and extends along the west side of the canal to the rock crushing plant, north of the Town of Thorold, a distance of nearly 8 miles, and which is double-tracked throughout its length, and equipped with 60-lb. rails, complete interlocking and block signal system, and telephone train despatching system, was built and is maintained by the Department of Railways and Canals for the use of the contractors in hauling excavated material from Sections Nos. 1, 2 and 3 to the harbor embankments in Lake Ontario, and for hauling stone, excavated from the site of the flight of locks at Thorold to the site of Locks Nos. 1, 2 and 3. The railway is well ballasted with stone and kept in such condition that no accidents of any consequence have occurred since it has been in operation.

There will be 22 bridges crossing the canal to carry existing highways and railways, as well as several bridges over pondages, one swing bridge carrying the construction railway over the present canal, and a temporary bridge for the Grand Trunk Railway over the foot of Twin Locks No. 4. A few of these will be swing bridges, where the conditions favor this type, but the majority will be bascule lift bridges, or bridges of what are commonly known as the "Jack-knife" type.

For construction purposes, the canal route has been divided into nine sections, section 1 being at the Lake Ontario end, and the others following consecutively through to Lake Erie. Of these nine sections, four are under contract at the present time, namely, Sections Nos. 1, 2, 3 and 5. Sections 1, 2 and 3 include all the locks, and the value of the work which they represent is practically equal to one-half of the estimated cost of the entire canal.

Lock No. 1 is situated at the Lake Ontario entrance just inside the shore line; Lock No. 2 one and one-half miles south; Lock No. 3 two and one-half miles south of Lock 2, and at the points where the Ship Canal will cross the present canal. Locks Nos. 4, 5 and 6 are double locks rising immediately one above the other, and these, with single Lock No. 7, a little further on, will raise and lower vessels 186 ft. over the escarpment at this point.

OUR PACIFIC COAST SHIPPING AND SHIPBUILDING

by A. H. Seaton

THE shipping industry of British Columbia is really just emerging from its infancy, and is only now on the threshold of what bids fair to be an era of great prosperity. The reasons for this are not difficult to find, being chiefly due to the newness of the country and the undevelopment of its resources, which, although almost unlimited, have so far hardly been touched; as a consequence, while there has always been a strong demand for import tonnage, no return cargoes have been available. Our Pacific Coast cities have not been able to offer inducements to shipowners that were worth considering when compared with those offered by those more fully developed on the adjacent coast of Washington. Although a thriving Trans-Pacific trade has been done for many years, we in this British Columbia have only recently begun to seriously take a hand in it.

An earnest effort is now being made to put the cities of this Province definitely on the map as shipping centres, Vancouver is by far the largest of these, with Victoria second. There are now represented in Vancouver three companies engaged in Trans-Pacific trade—The Canadian Pacific Steamship Lines, The Dollar Co., and The Canadian Australasian Royal Mail Line. In addition, there are several companies engaged in the coasting trade, the latter fast assuming considerable proportions. Chief among them are the C.P.R., the G.T.P., the Union Steamship Co., and The Terminal Navigation Co.

Wallace Shipyards

A few months ago an order was placed with the Wallace Ship Yards of North Vancouver for three large, five-masted schooners by the Canada West Coast Navigation Co., the intention being to place them in the lumber carrying trade. The principal dimensions of these vessels are as follow:—

SCHOONER E. R. WEST ON B.C. MARINE CO. WAYS, VANCOUVER.

Length over all, 250 ft.
Length on L. W. L. about 235 ft.
Beam outside of planking 44 ft.
Maximum draught 16 ft.
Total displacement 3,500 tons.
Tonnage for cargo 2,500.
Cost equipped $250,000.00.

The auxiliary propelling machinery will consist of 2-Bolinder, Semi-Deisel-engines of 160 b.h.p. each.

The Wallace Shipyards have also, with a commendable spirit of enterprise, undertaken the building of a fourth schooner of the above dimensions, with the intention of either operating or selling her, as opportunity may offer. This commpany has also an order of two steel twin-screw cargo vessels of 4,200 tons displacement, one for British interests, and one for Matsui & Co. of Japan. Their chief dimensions are:—

Extreme length over all, 315 ft.
Length between perpendiculars 300 ft.
Beam 45 ft.
Maximum draught 18 ft. 6 ins.
Depth of hold 27 ft.
I.H.P. of engines 1500.
Tonnage for cargo 4500, including coal carried in bunkers.

The Wallace Shipyards are also well equipped for handling ship repairs, having two marine railways, one of them being capable of docking vessels up to 2,500 tons' displacement. The other and smaller one is intended chiefly for vessels such as tugs and scows; it is nevertheless capable of docking vessels up to 1,000 tons displacement.

Situated in the City of Vancouver itself there are two other concerns engaged in the business of shipbuilding and ship repair—The B. C. Marine, Ltd., and The Vancouver Ship Yard. The first named has accommodation for docking vessels up to 2,000 tons displacement. It is quite a promising little plant, well equipped for all ordinary ship repairs, and being close to the new Government grain elevator and dock, is very favorably situated. While this company in past years have built quite a number of fairly large vessels, they have not so far taken the share in the present revival of the ship-building industry to which they seem to be entitled, but have confined themselves strictly to repair work.

The Vancouver Shipyard has a well equipped little plant for small craft, and has a marine railway which is capable of hauling out vessels up to about 600 tons deadweight.

Vancouver Drydocks, Ltd.

Arrangements have been made by Charles Meek for the erection of a plant which marks the beginning of a new era as regards Vancouver shipping. It will operate under the name of The Vancouver Drydocks, Ltd., and is calculated to fill a long felt want, all large vessels hitherto having been forced to go elsewhere when actual dry-docking was required, many hundreds of thousands of dollars thus being lost to Vancouver annually. The present intention is to build one double section floating drydock which will be capable of handling vessels up to 18,000 tons displacement, this being sufficient to accommodate the largest vessels on this Coast at present with ease. It is confidently expected that this dock will be in actual operation within the next twelve months. It is also their intention to operate an extensive ship-building plant.

The White Pass & Yukon Railway Co., have also completed arrangements for the building in Vancouver of two small passenger vessels, one for service between Cariboo and Taku, and one on

Atlin Lake. That for the river service will be a typical stern-wheel craft, 165 feet long by 35 feet, however, with accommodation for eighty passengers. The other will be a twin-screw craft propelled by internal combustion engines, of 90 feet in length by 18 feet beam, and with accommodation for 100 passengers. She is intended for daylight service only. These two vessels will be shipped North in sections, and assembled there.

Genoa Shipbuilding Co.

An order was recently placed with the Genoa Shipbuilding Co., of Victoria for three wooden schooners, similar in all respects to those now building in Vancouver. Two of these are now nearing completion, and should be able to go to sea early in the coming year. The only two companies in Victoria who combine ship-building with repairs are the Victoria Machinery Depot and Yarrows, Ltd., the latter firm having just completed a light draft steel vessel for the Indian Government. They are now erecting the frame-work of a second one. Both these firms are equipped with marine railways capable of docking vessels of 3,000 tons displacement.

The shipping of Victoria Harbor is chiefly composed of small coasting vessels engaged in log towing for the numerous saw mills. It is also the headquarters for the Pacific Whaling Co., who operate quite a numerous fleet. Victoria is also a port of call for almost all the larger vessels which berth at Vancouver.

A great amount of work has been done by the Dominion Government to improve the docking and berthing facilities of Victoria, an extensive system of piers being now under construction at the mouth of the harbour. These are sheltered by a magnificent breakwater which is now almost completed. The work was rendered necessary owing to the depth of water in the harbour proper being only sufficient for vessels of about 18 feet draught at all stages of the tide. The minimum depth of water alongside the piers under the shelter of the breakwater is now 35 feet, which is sufficient for the largest vessels at present plying to the Pacific Coast.

COLLINGWOOD SHIPBUILDING CO.

NEW and repair work carried out during 1916, and meantime in progress at the Collingwood Shipbuilding Co. plant, Collingwood, Ont., in addition to munitions production, includes the following:—

Vessels Built and Completed

S. S. Royalite, S. S. Iocolite, S. S. Sarnolite, each 250 ft. x 43 ft. x 18 ft., 800 I.H.P., and of 2060 British Board of Trade gross tonnage for the Imperial Oil Co.

Repair Work Completed

S. S. Mariska, S. S. Sarnian, S. S. SSarnian, S. S. Inland, S. S. Hamonic, S. S. Iroquois, Tug Onaping, S. S. Mariska, S. S. Malton, S. S. Thos. J. Drummond, S. S. Glenlivet, S. Si.S. C.G.S. Bayfield, S S. Iroquois, Tug D. S. Pratt, S. S. Fordonian, S. S. J. Frater Taylor, Tug C. W. Chamberlain, S. S. Kearsage, S. S. Honoreva, lighter Harrison, S. S. Caribou, tug Maitland, S. S. Collingwood.

New Work On Hand

Ship No. 48—For Montreal Transportation Co., 550 ft. x 58 ft. x 31 ft., Board of Trade gross tonnage 8000 tons, 2400 I.H.P.

Ship No. 49—250 ft. x 43 ft. 6 ins. x 25 ft., about 2500 gross tons, oil tanker for the Imperial Oil Co.

Ship No. 50—Similar to No. 49.

Ship No. 51—Cargo boat 251 ft. x 43 ft. x 20 ft., 1200 I.H.P., Board of Trade gross tonnage 2500, for Owners' Account.

Repair Work on Hand

S.S. J. A. McKee, S.S. Alberta, S.S. Glenlyon, S.S Iroquois, S.S. Imperial.

YEAR OF PROSPERITY IN ST. JOHN. N.B.

THE year 1916 has been one of the busiest in the history of St. John. The export trade of the port has broken all records and has placed it in the second place of all Canadian ports in this respect. The export values for the fiscal year ended March 31, 1916, amounted to $120,042,590, as against $43,872,932 in 1915 and $21,359,760 in 1914. Imports for 1916 amounted to $11,165,463; for 1915, $9,112,916; and for 1914, $9,433,220. For the six months from April 1 to September 30, the values of exports at St. John were $55,970,441. Halifax followed with exports of $19,538,644.

During 1915, the lumber shipments to the United Kingdom and the continent of Europe were as follows:—Spruce deals, 139,486,183 sup. ft.; hardwood plank, 4,333,709 sup. ft.; birch timber, 1,611 tons. The figures in 1914 were respectively 84,027,826 sup. ft. (spruce deals); 7,651,181 sup. ft. (hardwood plank); and 1,411 tons (birch timber). The lumber exports to the United States in 1915 amounted to $1,371,450.45. During the first three quarters of 1916, they were valued at $1,076,126.44, as against $994,279.30 in the corresponding period of 1915. Grain exports in 1915-16 were 14,186,522 bushels, valued at $11,405,186, compared with 8,612,703 bushels, valued at $8,738,780 the previous year. The customs receipts for 1915-16 were $2,706,891.57, as against $1,670,957.65 the previous fiscal year. During the twelve months ended March 31, 1916, 3,118 vessels, of 1,790,948 registered tons, entered the port, as against 3,178 ships of 1,587,493 tons in 1915.

The bank clearings at St. John for 1916 are a fair indication of the city's business progress. For the eleven months to December 1, they totalled $82,218,682, as against $70,365,188, for the eleven months of 1915. The first week in December exceeded the record of any previous year, with a total of $2,500,355, compared with $1,777,511, in the corresponding period last year. Building figures for 1916 to December 1, aggregate $462,350, as against $323,400 for the like period in 1915.

The postal transactions at St. John for 1916 have not yet been given to the public. For 1915, the total revenue was $148,316.51, as compared with $144,333.68 in 1914. Money orders issued in 1915 amounted to $401,873.69; in 1914 to $399,924.18. Money orders paid in 1915, $944,882.28; in 1914, $906,017.24.

The winter port season opened very auspiciously this year, six transport vessels from C.P.R. liners and 1 barkentine being loaded in November. At present, the piers are very busy, with the prospect of a much busier season ahead. It is hoped that another new pier, No. 16, will be ready early in the New Year. The Government elevator, which was destroyed in August, 1914, is being rebuilt on another site farther down the harbor, immediately south of the custom house. It will have an initial capacity of 550,000 bushels. The plant will not be ready for use this winter.

Industrial Development.

Speaking industrially, two large plants have been added to the city's industries during 1916. The most important of these is the McAvity machine shop, 80 x 400 ft., which was erected in six weeks and is now turning out munitions. The other industry is that of the manufacture of hydrated lime, which has been begun on a large scale by Messrs. Gandy & Allison.

On the whole, St. John has prospered in 1916. It tried out "Daylight Saving" during the past summer, and found it a success during the months of May, June, July and August. The Board of Trade is moving to have the plan made either Dominion-wide or Maritime Province-wide. That body has also entered upon a campaign to secure a fuller utilization of the port for British-Canadian traffic, its slogan being 'Canadian Ports and Canadian Railways for Canadin Business." The suggestion we understand is meeting with much acceptance both in Canada and Great Britain.

GRAIN EXPORT FROM MONTREAL

GRAIN received in the elevators of the Montreal Harbor Commission and the Grand Trunk Railway elevators up to the end of November 30, piled up the very respectable total of 71,646,455 bushels. Of this amount the Harbor Commissioners' elevators, according to a statement prepared for the Commission by Lieut.-Colonel F. Massey, provided 46,391,926 bushels, and the G. T. R. elevators the remaining 25,254,529 bushels. From the harbor elevators alone this is an increase over last year of 11,197,454 bushels, and the Grand Trunk total export also greatly exceeds that of last year.

The receipts in the Harbor Commissioners' elevators alone during the current season to the end of November were 47,658,804 bushels, and as two-thirds of this amount came in by rail, December will probably add some more to the total. In 1915, for the same time, the total receipts were only 34,862,861 bushels, so that there is this year an increase of 11,197,454 bushels.

OCEAN TERMINALS AT HALIFAX, N.S., AS THEY WILL APPEAR WHEN COMPLETED.

MUIR BROS. DRY DOCK CO.

AROUND the Muir Dry Dock at Port Dalhousie are laid up the following:—Steamers Garden City, Jas. H. Shrigley, Natironco; tugs Meteor, Eleanor, Crawford, Lynn B; dredges Chas. Boone and The Meade; concrete scow Pioneer; and Great Lakes Dredging Co. scows Nos. 38 and 39; drill No. 4, belonging to C. S. Boone Dredging Co., and four scows also belonging to the same firm. The steel dredges Fundy and Delver, and the tug Alice, belonging to the Dominion Dredging Co.; tug Meteor, of Port Colborne Tug Co., and the large scow No. 38, belonging to the Great Lakes Dredging Co., were among the late dockages made. The Dry Dock has had a busy season repairing wooden boats for the most part, although several steel ships were also docked, and we hear that this establishment, so long associated with the repairing of wooden boats, is to shortly branch out into metal work, which will be an added convenience for lake shippers generally.

OCEAN TERMINALS AT HALIFAX, N.S., AS THEY WILL APPEAR WHEN COMPLETED.

WESTERN DRYDOCK & SHIPBUILDING CO.

DURING the past year the Western Dry Dock & Shipbuilding Co., Port Arthur, Ont., completed two full canal size ocean going freighters, 261 ft. x 43 ft. 6 in. x 28 ft. 2 in., having triple expansion engines, with cylinders 20, 33 and 54 in. in diameter, by 40 in. stroke, supplied with steam by two Scotch boilers operating under natural draught, each 14 ft. 6 in. in diameter by 11 ft. long, of 190 pounds per sq. in. working pressure.

The machinery was placed amidships. Four cargo hatches were provided to each vessel, two forward and two aft.—26 ft. by 18 ft. Deck and other equipment consisted of six 4-ton American Hoist & Derrick Co. winches; 8 in. by 8 in. American Shipbuilding Co. windlass and steam steering gear; 7½ k.w. Engberg electric lighting outfit; steel masts, cargo derricks, etc. In the case of both ships, Thorgerd and Blaamyra, delivery was made five months from date of laying the keels. Six more of the same type of vessel are under contract for delivery in 1917.

At the present time the capacity of the plant is being doubled, this involving an additional building berth and additions to slips. The concrete drydock in connection with the plant — 700 ft. x 100 ft. x 16 ft.—was utilized during the year to carry out extensive repairs on some 35 vessels, and, in addition, to facilitate the carrying out of minor repairs on many others. The various departments of the plant are modernly equipped, individually electrically driven tools being prominent features. At present, 800 men are on the payroll but early in 1917, it is expected, that 1,200 men will find steady employment The departmental constituent of the plant embraces shipyard, machine shop, blacksmith shop, boiler shop, pattern shop, iron foundry, pipe, electric, and joiner shops.

NOVA SCOTIA STEEL & COAL CO.

AT New Glasgow, N.S., the Nova Scotia Steel & Coal Co. have one steel cargo steamer of 220 ft. B.P., 35 ft. beam, and 20 ft. moulded depth, under construction. This boat should be completed some time in the early spring, 1917. She will be fitted with two Scotch marine boilers, 11 ft. 6 ins. in diameter and 11 ft. 6 ins. long, of a working pressure of 185 pounds per sq. inch., and De Laval steam turbines developing about 1,000 b.h.p. geared to the propeller by means of two reduction gears, reducing the speed of the turbines from 4,000 to 80 revolutions at the propeller. This is the first De Laval turbine to be installed in any steamship for propelling purposes, and the first of any kind in Canada. The boat will be fitted with large hatches and complete cargo discharging gear.

There are also two ships in the early stages of construction, each of 248 ft. 9 ins. B.P., 35 ft. beam, and of 20 ft. moulded depth. These two boats will be fitted with triple expansion engines and two Scotch boilers. Their completion is expected in the latter part of 1917.

PORT OF MONTREAL, 1916 SEASON

THERE came to the port of Montreal for cargoes, during the season which is now closed, 685 sea-going vessels with a total tonnage of 2,119,051, as against 815 vessels last year with a total tonnage of 2,261,374. Although the two totals compared seem to show that last year's business transacted by the port was more than this year, it is believed that further analysis of the figures will show that, if the coasting tonnage included in the returns for all the years were eliminated, the total of ocean-going ships this year would exceed that of any year in the history of the port.

Coal, for example, which has formed in other years a great part of the cargoes brought up to Montreal from the Maritime Provinces, has come in comparatively small quantities this year because of the difficulty of getting tonnage. Last year there were probably two or three times as many coasting vessels as this year. The average capacity for cargo of the ships, which came this year, is also ahead of last year, another result of the large number of coasting vessels in last year's list.

Grain has again formed the major portion of the port's exports. Up to the end of November the exports from the elevators of the Harbor Commissioners and the Grand Trunk Railway reached the goodly figure of 71,646,455 bushels.

BIG CONTRACT ABANDONED

THE seven million dollar contract for the improvement of the port of St. John (Courtenay Bay side) has been thrown up by the contractors, the Norton Griffiths Co., and all work discontinued.

The St. John harbor works were part of the general scheme of the present Government for the improvement of Canadian ocean ports. A good deal of work has been done, but the contractors, who were to have completed the larger part of the improvements by next spring have not made the necessary progress and are now apparently unable to go on. In addition to the actual harbor work, the plans included the construction of a large drydock on a subsidy basis.

It is regarded as unlikely that the Public Works Department will take over the uncompleted work. If the completion is not to be deferred until after the war, the contract will probably be transferred. Something like $3,000,000 has already been expended on undertaking.

THOR IRON WORKS, LTD.

AT the Thor Iron Works, Toronto, a full canal-size ocean-going freighter, 261 ft. long, x 43 ft. 6 ins. beam, x 28 ft. 2 ins. deep, is at present under construction for delivery on May 1, 1917. A similar vessel is on order for delivery in September, 1917. During the present year, in addition to general steel plate work contracts completed and in progress, a considerable number of marine repair jobs—large and small—were successfully negotiated.

CANADIAN VICKERS, LTD.

THE bulk of the work carried out during 1916 at the plant of Canadian Vickers, Ltd., Montreal, was for naval and military requirements, the specific details of which for obvious reasons are here withheld. The ice-breaker J. D. Hazen, originally contracted for by the Dominion Department of Marine and Fisheries, and later transferred to other owners, was launched in May and completed in November. A steel twin screw centre ladder hopper and barge loading dredge, also for the Dominion Department of Marine and Fisheries, was launched on November 18, her leading dimensions being as follows:—Length between perpendiculars, 284 feet; breadth moulded, 48 ft.; depth moulded, 20 ft. 6 ins.; mean draught, 16 ft. 6 ins.; dredging depth in specified condition, 57 ft. Contracts on hand include the construction of two 7,000 tons deadweight cargo steamers for neutral owners, with delivery in 1917. The floating dry dock Duke of Connaught was largely taken advantage of during the season of navigation, no less than 36 ships having been docked and repaired, including considerable repair and other work on transports. A number of repairs were also carried out to vessels afloat in Montreal harbor.

POLSON IRON WORKS

NO new vessel construction featured the activities of the Polson Iron Works, Toronto, until the last quarter of 1916, when work was started on the building of two ocean going freighters for Norwegian owners. The leading dimensions are as follows:—Length over all, 261 ft., between perpendiculars, 251 ft.; beam moulded, 43 ft. 6 ins.; depth moulded, 22 ft. 11½ ins.; deadweight 3,500 tons. The usual repair and outfitting of lake craft was carried out during the season of navigation; however, munitions manufacture constituted the major part of the plant production.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S.S. "W. B. MORLEY"

An investigation was held at Quebec, Nov. 17, 1916, before Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Capt. Chas. Koenig and Capt. L. R. Demers, acting as nautical assessors into the causes which led to the damage sustained by the S.S. W. B. Morley, when being swung in the neighborhood of Plum Island, on June 17, 1916. The principals were unrepresented by counsel.

The W. B. Morley was a wooden ship of 1,892 tons gross, carrying a crew of 17, including two officers and two engineers, having a speed of 9 miles, draft of 14 ft. and single screw compound engines. According to the master, Hector Larosie, the vessel left Montreal in light wind and clear weather, having on board a pilot, George Perreault, but was overtaken by a fog after passing Vercheres Range Light which was then in line astern. The vessel was immediately swung around and headed westerly, the anchor dropped with 30 fathoms of chain and hoisted immediately, and the lead used and 10 fathoms reported although witness did not think the soundings given were exact or reliable. The ship touched twice, once severely, and anchored at Lanoraie, afterwards proceeding to Sorel to ascertain the amount of damage which was done to both hull and rudder.

Pilot George Perreault deposed that when the fog came on he ordered the helm astarboard, ran slow for a short interval under starboard helm and ordered hard aport, when he felt a slight tremor. While he did not give the order to anchor, it was with that intention the ship's course was altered.

The evidence of the wheelsman and the Court found that the contradictory nature of the evidence was largely due to forgetfulness of events, and the pilots action was the only matter to be discussed. If it was the intention of the pilot to anchor when the fog came on, he should have stopped her in the course and let go the starboard anchor, and the tide of one and a half miles at that place would have swung the vessel gently either one side or the other, or else have canted the head of the vessel to starboard slightly, which would have answered the purpose and assured the pilot and master that the vessel would swing as desired.

Instead of the above, the ship was caused to leave midchannel on a starboard helm, and after a short interval, to evolute under a hard to port helm, and whilst swinging to the starboard side her heel struck shoals, injuring the vessel's keel and rudder to a certain extent, then the vessel was allowed to come head to tide before the anchor was let go. In view of the above no other conclusion can be arrived at than that the pilot showed lack of judgment in that evolution, and he was accordingly condemned to pay the cost of the inquiry amounting to $108.75, the master being reprimanded for permitting certain laxity of discipline during the occurrence.

"VALETTA"—"SOL BAKKEN"

On December 6th, 1916, a formal investigation was held in the Court House, Halifax, N.S., before Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Com. E. Wyatt, R.N.R., and Capt. R. Jones, into the causes which led to the collision between the S.S. Valetta and S.S. Sol Bakken on October 4, 1916, at a place near or off Cape Dogs, in the River St. Lawrence.

The Sol Bakken is about 320 ft. long, with a net tonnage of 1,662, and according to the evidence of the chief officer, was travelling at full speed, about 8 knots, drawing 15 ft. aft and 7½ ft. forward, that the full crew of 26 was not aboard, and the voyage was being made direct from Dieppe, France, to Montreal. His evidence, along with that of the third engineer and two ordinary seamen, was as a result of special circumstances obtained by counsel at their office, while the evidence of the Valetta and the respective pilots was obtained as above on the return of the latter vessel to Canada.

The Sol Bakken was on her inward voyage, and her master was ill, being practically unable to attend to his duties on the bridge. Her chief officer was on deck from midnight until the collision occurred, the pilot having been on the bridge 1½ minutes before the collision, prior to which he had been absent about half an hour. The weather was clear, with no moon and little wind, and while steering the pilot's course of S.W. ¼ W. by compass, a masthead light and red light were seen about a quarter of a point on the port bow. Considerable changes in the course were made as a result of the behavior of the other vessel, which gradually approached until about four ships' lengths off, when both side lights were seen about two points on the starboard bow. The helm was then ported and the ship kept at full speed. No signals were given; and a first attempt to blow the whistle was useless because of water in the pipe. Full speed astern was now given, with three blasts from the whistle, which were similarly answered by the Valetta. The collision occurred one and a half minutes later, both vessels touching port to port about half-way between the stem and bridge. After the collision, the helm was starboarded and engines put full steam ahead when the body of the Valetta was clear, thereby clearing her stern, after which the engines were stopped.

The Valetta, according to her master, is a single screw steel built vessel of 3,721 tons net, with a speed of 11 knots, ordinarily carrying a crew of 44, but presently short-handed. She had a draft of 25 ft. 4 in. aft and 24 ft. 4 in. forward in fresh water at Montreal, carried three officers, and is owned by Gow, Harrison & Co., Glasgow. He came on the bridge very shortly before the collision in response to a call from the second officer, but gave no orders, as everything possible had been done. The second officer gave a detailed narrative of his orders preceding the accident, and was followed by the pilot, who referred to the Valetta sheering occasionally.

The analysis of the Court was of an extended nature, dealing in detail with the actions of each individual, the finding being to the effect that both vessels were to blame through indecision caused by changes of course. The masters of each vessel were exonerated from blame, but the chief officer of the Sol Bakken was remiss in his duty, and the attention of the proper foreign authorities would be called to his behavior. The pilot committed a grave breach of discipline by leaving his post, but instead of dealing with his license, imposed a fine of $400. The second officer of the Valetta was reprimanded for leaving the bridge at the crucial moment, but his certificate is not dealt with. The pilot, because of the sheering which he noticed several times, is found severely at fault and fined $300.

SHIPBUILDING OUTLOOK

By H. A. Brittain.*

CONCERNING the present outlook of the shipbuilding industry, we might say that in our opinion, for several years at any rate, Canadian shipbuilding yards will be filled to capacity. Of course, all shipbuilding plants on the Great Lakes are hampered on account of the fact that the largest vessel that can be sailed to salt water is only as large as can be accommodated by the locks on the St. Lawrence River canals. The vessels we are building give the maximum length that can be sent down in safety.

Immense strides are being made and will still further be made in Canada and the United States as regards ship con-

*Asst. Manager and Treasurer, Thor Iron Works, Toronto.

struction, mergers being put through at the present time combining shipbuilding yards and steel mills having that end in view. By such means it will be seen that prompt delivery of the necessary material will be more readily secured. Canada is depending at the present time for her sole supply of steel for shipbuilding purposes on United States mills, and if the shortage of steel for general manufacturing purposes continues, there will be great difficulty in getting steel for ship work.

Plans are under way at the present time for steel rolling mills to be started in Canada on a large scale. It, however, will take some few years to produce the necessary output, and until such time as this takes place, we will have to depend largely on the United States. The growth of the shipbuilding industry in Canada will depend on prices and deliveries of material. We might also state that we are planning to double our output in 1918, namely, to turn out four complete ocean-going freighters.

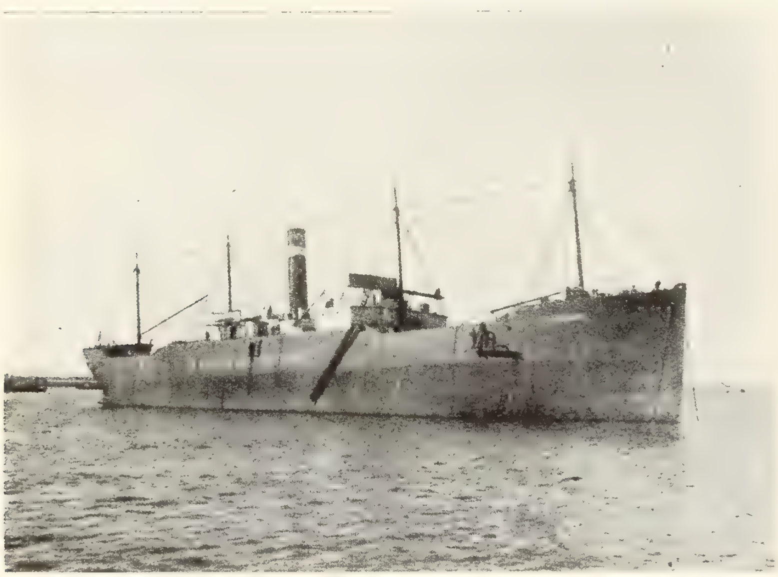
BRITAIN COMMANDEERS OCEAN FREIGHT SPACE

LIEUT. CONNOR GUTHRIE, representing the British Admiralty in New York, summoned freight managers of the British Steamship Companies to a conference on Dec. 27, and told them that, beginning on January 1, 1917, the British Government would require 85 per cent. of the cargo space on their ships. Forty-seven and nine-tenths per cent. is to be reserved for war munitions and the remaining thirty-eight and one-tenth per cent. for wheat.

During the greater part of last year the British Government has reserved 60 per cent. of the space on vessels flying its flag. On Dec. 15 Lieut. Guthrie called a meeting of the freight managers and informed them that the Government would require 70 per cent. of the space, and the further revised increase to 85 per cent. came as an unwelcome surprise, as there are about 100,000 tons of freight waiting shipment in New York, of which one-fourth is ordinary commercial cargo consigned to firms in Great Britain.

UPS AND DOWNS OF A FREIGHTER

HOW a wrecked freighter was sold as scrap for $10,000 and, after five years' existence on the scrap heap, refitted and sold at a profit of $67,500, is related in Syren and Shipping, and forms an interesting side light on shipping conditions as affected by the war. As the ss. Llansannor, the vessel was wrecked in 1910 on the breakwater at Monte Video, being subsequently got off, but in such a badly damaged condition that she was declared a total constructive loss and sold for $10,000. It may be mentioned that she is a steamer of 3,568 tons gross, built in 1900 at West Hartlepool, and at the time of the disaster was classed 100 A1. By degrees she was being broken up, as she lay at Monte Video, the boilers being taken out and sold, as were the pipes and other fittings. However, when the market value of tonnage began to soar to fantastic heights, it occurred to S. A. Calcagno, the then owner of the vessel, to take her in hand and render her fit for service again. Accordingly in November, 1915, he asked Townsend Brothers, of London, to send out from England a set of cylinders, stern frame, a boiler and other new parts, the cost of which was $62,500. The cylinders, pistons and piston rods were put on board ship at Liverpool, all connected up and ready to lift direct into the Llansannor. The shipment was made on June 28 last, and the repairs had been carried out and the vessel delivered to buyers in Buenos Ayres on Aug. 14. She changed hands at about $700,000. It may be added that Lloyd's sent a special surveyor from Buenos Ayres to see the repairs carried out, and the vessel was in due course restored to her original class of 100 A1.



THE "LLANSANNOR" AFTER REPAIRS WERE COMPLETED.
SHE HAS BEEN RENAMED "LA MARSEILLAISE"

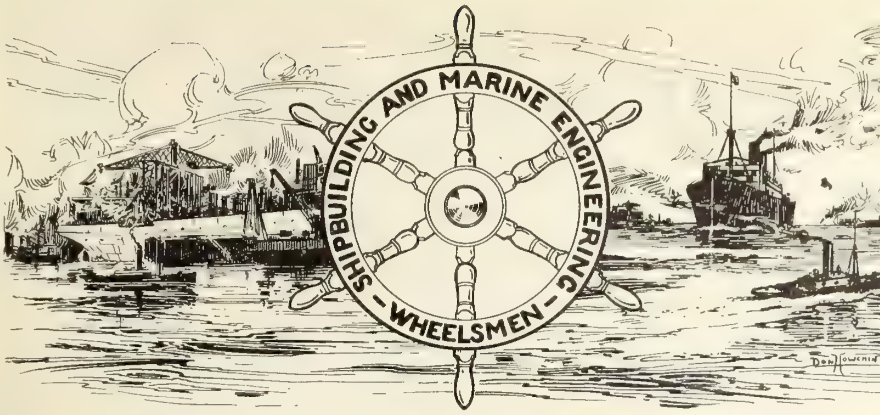
"ISHERWOOD" SYSTEM OF SHIP CONSTRUCTION

THE number of "Isherwood" vessels contracted for to date in this year is 152, with a total gross tonnage of about 698,875, which is equivalent to about 1,000,000 tons in deadweight-carrying capacity, thus making the total number of vessels built, under construction and on order 620, with an aggregate deadweight-carrying capacity of over 4,500,000 tons. Whilst the "Isherwood" system has achieved an overwhelming predominance in some types of craft, the following analysis of the 620 vessels referred to above shows most distinctly the suitability of the system for all types and classes of vessels:—265 oil tank steamers, aggregating 2,413,750 tons deadweight-carrying capacity; 25 colliers and ore steamers, of 255,000 tons deadweight-carrying capacity; 9 passenger vessels, of 44,600 tons deadweight-carrying capacity; 24 Great Lakes freighters, of 279,060 tons deadweight-carrying capacity; 73 barges, of 25,850 tons deadweight-carrying capacity; 221 general cargo vessels, of 1,645,200 deadweight-carrying capacity; 2 dredgers, of 760 gross register tons; 1 trawler, of 570 gross register tons. In the United States of America well over 90 per cent. of the oil-tank tonnage at present under construction and about 50 per cent. of the total merchant tonnage is claimed by the "Isherwood" system, as is also a very large proportion of the merchant ships now being built in Japan.

AUSTRALIAN RESTRICTION ON CANADIAN SHIPPING

THE Canadian Government is now negotiating with the Australian authorities with regard to loadline restrictions at present imposed on Canadian ships trading to ports of the Commonwealth. The matter has become of immediate importance in connection with the construction on the Pacific Coast of wooden ships designed to carry lumber from Canada to the Antipodes. Partly as a result of subsidies by the British Columbia Government, there has grown up in the Pacific Province a wooden shipbuilding industry of considerable proportions. Numbers of vessels of from 1,500 to 3,000 tons are being turned out, being designed as four and five masted schooners with auxiliary Diesel oil engines.

These vessels will enter into competition with American-built ships, which trade to Australia and which have hitherto carried much Canadian lumber as well as pitchpine to Australia and New Zealand. They are under a great disadvantage, however, in that all British vessels trading into Australian ports are subject to loadline restrictions which would considerably reduce their carrying capacity as compared with American vessels to which restrictions would not apply. The Marine Department has had the matter taken up with the Australian Government and it is expected the discrimination which exists under the present regulations will be done away with.



The success of shipbuilding and marine engineering enterprise is largely dependent on its "Wheelsmen." This series of articles has for its object the featuring in a racy, interesting and instructive fashion, the personal training, experience and achievement of those who to-day in Canada are energetically and effectively navigating the twin craft to higher degree prominence in their capacity as designers, constructors, outfitters, etc.

JOHN SHARP

THE war-created prominence accorded shipbuilding and marine engineering on this North American continent has had the specific effect—and more especially in Canada—of bringing into the limelight a section of the industrial community, who, from lack of demand for their handicraft, had been, if not altogether outside the pale of nation builders, at most but contributory in much restricted degree. John Sharp, chief engineer, Polson Iron Works, Toronto, Ont., is of the number. His firm, in common with others recently or long established, have not only their every available shipbuilding berth filled with ocean-going freighters in varying stages of construction, but carry on their books a sheaf of contracts for vessels of a like type, calling for earliest possible delivery, and, making necessary as a result, plant extensions ranging all the way from 100 to 200 per cent. normal or prewar capacity.

John Sharp—what the name lacks in ornamentation it expresses in keenness, relative to personality or otherwise—was born at Brantford, Ont., May 26, 1886, of Canadian - by - birth parents—Benjamin and Rachel (Near) Sharp, who, it may be stated, also first saw the light under our Dominion sky. He received his education in the public and high schools of his native city, following which, during the years 1902-1906, he served a four years' apprenticeship in the draughting office of the Waterous Engine Works. In the latter year he joined the engineering staff of the Dyment Foundry Co., of Barrie, as chief draughtsman, occupying that position until associating himself with the Canada Foundry Co., Toronto (now Canadian Allis-Chalmers Co.), in 1908. The variety experience gained in the plants above enumerated laid, as it were, the foundation for not only an enlargement of the scope of John Sharp's general mechanical engineering bent, but developed both his inquisitiveness and acquisitiveness relative to other fields of metal-working activity.

In 1910, therefore, we find him transfer his services from the Canada Foundry Co. to the engineering department of the Polson Iron Works, and here it may be in order to say that, with his promotion to the post of chief engineer of the latter concern some four years ago, he has found opportunity for the exercise of his skill in a specific class of product to which his endowment of talents has

JOHN SHARP

been naturally adapted. The manufacturing output of the Polson Iron Works covers a wide range, embracing as it does general mechanical, steam, and marine engineering, shipbuilding and ship-repairing, and, when it is remembered that John Sharp's experience previous to 1910 was largely, if not altogether, confined to engineering equipment for ashore service, much credit is due him for the apt—*sharp,* if you like, way he has in these recent years appropriated to himself an honored place among Canada's naval architects and marine engine and boiler designers. With the practical certainty of a decade of more or less abnormal activity in shipbuilding and marine engineering within our borders, his star with respect to same is likely to continue in the ascendant.

Mr. Sharp is unmarried, although quite as eligible to pass from that state to the other as to develop into a naval architect from eight years' experience as a mechanical engineer; besides, and judging from his devotion to his chosen and adopted craft and calling, there is little doubt but that a like disposition would mark his matrimonial enterprise, and, therefore, in course its equal success. We might say that in the few brief moments during which the more personal data connected with this career sketch were being acquired, our single or married query brought out the information—single [at present], the words in brackets being, however, hastily withdrawn. The outlook, needless to say, gives promise of a thinning out of the ranks of bachelordom at an early date.

In politics, Mr. Sharp says he is Independent, which, in nine cases out of ten as regards the engineering fraternity generally, means that little or no interest is taken—lack of time, and little or nothing in common, being good and sufficient reason for not taking sides. In religious creed he is Anglican—engineers are usually found associated with progress and uplift, and, therefore, belong to one or other church denomination. In matters military, he holds a commission in the 12th Regiment, York Rangers, a circumstance by no means surprising when account is taken of the prominent part that engineering of every kind is playing in this great European war. He had as a matter of fact enlisted for Overseas Service and had quit his work, but because of the equally important duty of helping to eliminate the shipping shortage, his recall was officially ordered. He is a member of the A.F. and A.M., the Engineers' Club, Toronto, and of the Society of Naval Architects and Marine Engineers, New York. His residence is at 121 Carlton Street, Toronto.

"The engineering profession," says Mr. Sharp, "embracing as it does so many branches and departments, presents a variety of opportunity to every young engineer or mechanic who cherishes the desire to advance. He should, therefore, concentrate both his studies and his energies along one line until that is mastered, both in theory and practice. Present-day educational facilities—technical schools, technical and trade papers, technical and practical text books, are available and within easy reach, furnishing reliable stepping stones to position after position of advantage, regardless of initial circumstances or vagaries of environment."

H.M.C. TORPEDO BOAT "GRILSE"

The Editor,
Marine Engineering of Canada,
143-153 University Avenue,
Toronto, Canada.

Dear Sir,—In the December number of your publication, I notice an article entitled "H.M.C. Torpedo Boat 'Grilse,'" together with an editorial on this article called "The 'Grilse" Near Tragedy." As I purchased the "Grilse," and also served as her commander for about a year, I think an explanation of your two articles from me are in order.

In the first place, the picture you published of the "Grilse" is not the "Grilse." Of course, I can understand that your article might be justified if the "Grilse" were such a type of ship as your picture shows, because I would not consider the photograph you published as a ship that I would care to go to sea on in the Atlantic in the winter months.

After purchasing the "Grilse," and before she was used by the Department of the Naval Service and altered for war purposes into a destroyer, a report was made by a man who had charge of building British destroyers for a great many years, whose report I would like to quote as follows:

"As requested, I have recently carried out a survey of the hull structure of H.M.C.S. 'Grilse,' and find this vessel similar in scantling to the early thirty-knot destroyers of the British Navy, but the details of the structural design are more in accord with the latest destroyer practice, and give the vessel more strength than in the old thirty-knotters.

"There are no indications that the vessel is in any way strained, or likely to be strained, provided she is navigated with the usual care necessary in all vessels of this class, none of which will, or are expected to, stand hard driving in bad weather."

I herewith enclose a photograph taken of the "Grilse," from which you will see that there is not the slightest similarity between the "Grilse" and the photograph you published, and I may further state that the "Grilse" is over two hundred feet long, and constructed of the finest high tensile steel, and was not built by Thorneycroft, as you state, but by Yarrows, in England.

Yours truly,
(Signed) J. K. L. Ross.

Smith got married. The evening of his first pay-day he gave his bride fourteen dollars of the fifteen-dollar salary and kept only a dollar for himself.

But the second pay-day Smith gave his wife one dollar and kept fourteen dollars himself.

"Why, John," she cried, in injured tones, "how on earth do you think I can manage for a whole week on a paltry dollar?"

"Darned if I know," he answered. "I had a rotten time myself last week. It's your turn now."

MACHINE TOOLS ON BOARD SHIP

SOME months ago J. Hamilton Thomson read a paper—which appeared in our editorial columns—before the Institute of Marine Engineers, strongly advocating the use of power-driven tools on board ships. In the November issue of the Institute's *Transactions*, J. Vesey Lang takes up the further discussion of the subject, which in part is as follows:

The chief difficulty in the way of power tools being generally adopted is the lack of suitable tools on the market. Again, in most cases there is little room on existing ships. He then says:

Some years ago I gave the subject some considerable thought, and wrote to several toolmakers on the subject of a lathe for the engine-room. I made inquiry through factors, but received no enlightenment. I attended an Engineering Exhibition, at that time being held at Olympia, London, England, and interviewed several principals of machine tool firms, who promised to write me and submit offers. I do not remember to have received any replies. It must not be overlooked that the last thing an English manufacturer desires you to put before him is something at all different from what he makes and what he thinks ought to suit you. If he is at all busy he simply does not want to be bothered with you. Elaborate and costly machines will never find a ready place aboard ship.

I am, of course, only alluding to the typical "tramp" steamer that forms the back-bone of the British Mercantile Marine, viz., the usual East Coaster built for $8\frac{1}{2}$ to 9 knots sea speed. Briefly for the purpose of a "standard" type of ship lathe, I would divide this class up with four ranges or sizes of lathe. The average size of engine parts of a half-dozen of the best known cargo type engine builder will very nearly approximate to the following groups for deep-sea steamers:

(1)—Up to 3,500 d.w.
(2)—3,500 to 5,000 d.w.
(3)—5,000 to 7,500 d.w.
(4)—7,500 to 8,500 d.w.

This will give you approximately a range of h.p. cylinders of 21 in., 23 in., 25 in., and 27 in. diameter, which would dominate the greatest diameter (in the gap) that could be economically used abroad. This would give us, approximately, $7\frac{1}{2}$ in., 8 in., $8\frac{1}{2}$ in., and 9 in. centre lathes respectively. Anything under $7\frac{1}{2}$ in. is a toy and over 9 in. (or thereabouts), too large for a tool aboard ship. For length between centres, I would make the feed and bilge pump rams the maximum, which would give about four lengths of 3 ft. 6 in., 4 ft., 4 ft. 6 in. and 5 ft. For main valve spindles the working part comes well within these lengths of centres, and the poppet can be substituted by a bearing block. The above are my ideas of maximum requirements in a lathe for ship work.

Briefly, the lathe should have a three-speed cone with back gear; a leading screw; change wheels—for screw-cutting—machine-cut gears; compound slide rest mounted on saddle with angle adjustment; gap opening, sufficiently wide to pass a valve spindle crosshead; a face-plate, a dog-chuck, a full set of tools, and a spare set of centres; a countershaft and brackets with "Balata" belting and fasteners. Leather is no good in a hot temperature. N.B.—I do not consider that either a back-shaft for separate self-acting feed is necessary, nor traversing feed screw to the saddle, as neither duplication nor time form the main considerations, and the inclusion of these would add to the prices named.

Now for the motive power. If a dynamo aboard then a motor would be the best; otherwise a small steam engine bolted to the bulkhead similar to the little engines used on board ship (by repairers), for boring cylinders, etc.; say, a 3 in., $3\frac{1}{2}$ in., 4 in., and $4\frac{1}{2}$ in. cylinder engine for the above lathe.

No lathe aboard ship would be serviceable under all or any breakdown conditions without hand power, as the motive power itself might be the subject of repair, or no steam be available. Therefore, some form of man-power is required. Foot-power is almost at its limit on a $7\frac{1}{2}$ in. centre lathe. By far the best arrangement would be (and I have never seen it in any lathe list) a hand-wheel drive on a bracket bolted to a bulkhead, and with a belt or rope drive to the countershaft. One or two men are always available for such an emergency under sea conditions or in foreign ports.

Some of the members are quite wrong in describing engine-rooms in general as "roomy." I am acquainted with many steamers where one would be hard put to find room for a lathe at all. Briefly, steamers with two main boilers have side and reserve bunkers on both sides in the machinery space, and the engine platform space is very limited. In steamers having three main boilers abreast there is no room at the sides for bunker space, and consequently no reserve bunkers in the engine space. In these jobs there is ample floor space. Sometimes the steering engine recess might accommodate a lathe across its front, and sometimes the valve recess (if decked) is roomy. Wherever a lathe is put, it should have provision allowed for the length of a main valve spindle to extend beyond the bed-plate; either a doorway or a hole through a bulkhead. In the latter case if put in to a bunker or cargo space a boxing or tubed recess would be necessary. The lathe would require to be firmly seated, and if on the existing engine platform, some extra support would be required under the ordinary platform bearers to carry the extra weight and vibration.

In the matter of cost, the crux of most things, I would certainly not call the average shipowner the stumbling-block to efficient equipment. I have shown that no special ship lathe is on the market such as I describe as needed. Judging from lathe values I have had to do with in pre-war times, such lathes should be procurable (on a pre-war basis) at about \$200, \$250, \$300, and \$350 respectively,

(Continued on page 20.)

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Axuiliary Product Achievement

NOVEL STEAM TRAP.

THE steam trap or drain cock illustrated, is one of those devices that seem to defy the laws of physics. In construction it is extremely simple and in operation quite effective, but the true explanation of its functions is difficult. Fig.

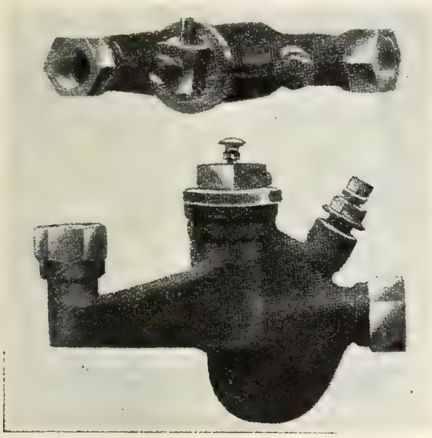


FIG. 1. PLAN AND ELEVATION OF TRAP.

1 shows general views of the trap, and Fig. 2 is a sectional elevation. It comprises a body or outer casing A, an automatic combined discharge and piston valve B, an adjustable screw valve C, a blow-through air valve D, and a cover E to give access to the piston valve. The latter is a loose fit in the body, and allows steam to pass to its upper surface and through the valve C. The makers are James Baldwin & Co., Keighley, England, who claim that the action of the apparatus is due to dynamic impulses, like "water hammer." The sectional illustration shows the trap in its normal condition, condensation water

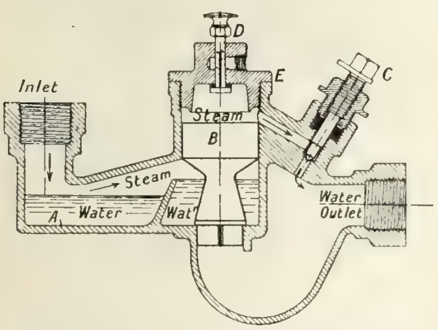


FIG. 2. SECTIONAL ELEVATION OF TRAP.

having accumulated in the inlet side of the body and below the piston valve. The following explanation of the action of the trap is given by the makers:—

The water at A is drawn by the flow into the pocket under piston B until full. The next following water then traps a certain quantity of steam between the top of the water in the pocket and the underside of the piston B, compressing and increasing the pressure of the steam trapped, thereby lifting the piston, opening the outlet valve, and discharging the water. The action is intermittent, the water being ejected in pulsations varying between 40 and 60 per minute, according to the setting of the regulator valve C. Upon this device the action of the trap depends.

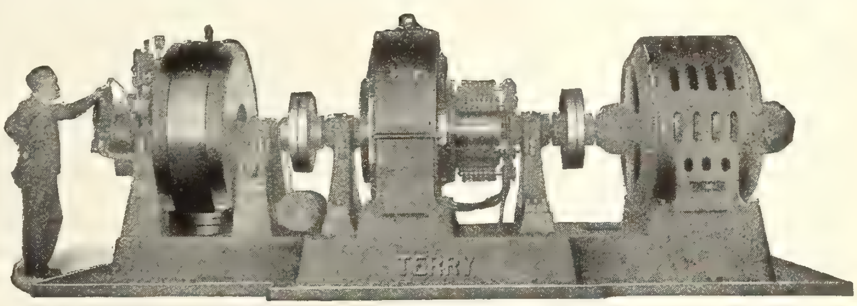
To start the trap the regulating valve is opened full. The steam is then turned on to the trap, through which it is discharged freely. Then the regulating valve is gradually and partially closed. Condensation takes place, and the temperature falls to normal, after which the trap can be finally adjusted to discharge either water mixed slightly with live steam or water of high temperature, i.e., not less than 205 deg. or 206 deg. Fah. We understand that the relative areas of the piston and discharge valves are not of essential consequence, the makers having constructed for experimental purposes traps of this kind, in which the piston and valve were of similar diameters. In this case it was only necessary to increase the opening of the regulator C to secure the extra energy necessary to open the discharge valve.

EXCITER UNIT WITH DUPLEX DRIVE

THE exciter unit shown in the accompanying illustration is one of a number now being installed in the new power plant of the Buffalo General Electric Co. These sets are of large capacity—300 k.w. normal—and are provided with two independent sources of power for driving each exciter.

Each unit consists of a 300 k.w. exciter direct-connected to an induction motor at one end and to a steam turbine at the other end. The governing mechanism of the turbine is so arranged that if the power for the induction motor should fail, the turbine would automatically pick up the load. In case of trouble on the main circuits, the exciters can be depended upon to take care of themselves without attention, and the operators can give all their attention to clearing up the trouble on the main circuits, while with ordinary motor-driven exciters the exciter unit shuts down as soon as the voltage of the main circuit fails, and it is necessary to start up an independent unit before voltage can be restored to the main circuits.

Another advantage of the Duplex Exciter Drive is that it gives the exciter unit a higher all-day efficiency than either a motor-driven or a steam-driven exciter. This maximum efficiency is secured by driving the unit from the turbine end when the station is operating at full load and the turbine exhaust can be used efficiently in the heaters, and by shifting the drive to the motor end when the station load is light, and the main generators can easily carry the exciter load. The turbines were manufactured and the units assembled by the Terry Steam Turbine Co., Hartford, Conn.

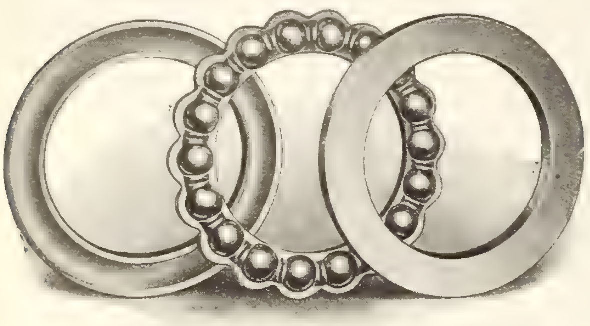


EXCITER UNIT WITH DUPLEX DRIVE.

BALL THRUST BEARINGS

THE Rochester Ball Bearing Co., Inc., of Rochester, N.Y., has introduced a line of ball thrust bearings which, while they do not incorporate any radical departure from generally accepted good practice in this line of manufacture, embody a number of interesting features. Of special merit in these bearings is the solid brass retainer. Experience has shown that a large proportion of ball thrust bearing failures are traceable to the use of sheet metal retainers, which wear rapidly, allowing particles of steel to fall into the races. The shock and extra wear, due to the balls running over these particles, eventually ruins the bearing. This, it is claimed, cannot happen with solid brass retainers. These bearings are usually made with round grooves, although V groove bearings are regularly

made for high speed, light duty conditions, special bearings being, in addition, made to order. Thrust bearings for heavy duty are made with self-aligning spherical seat washers. The illustration shows medium weight bearings of large size. The retainers of small bearings are not scalloped.



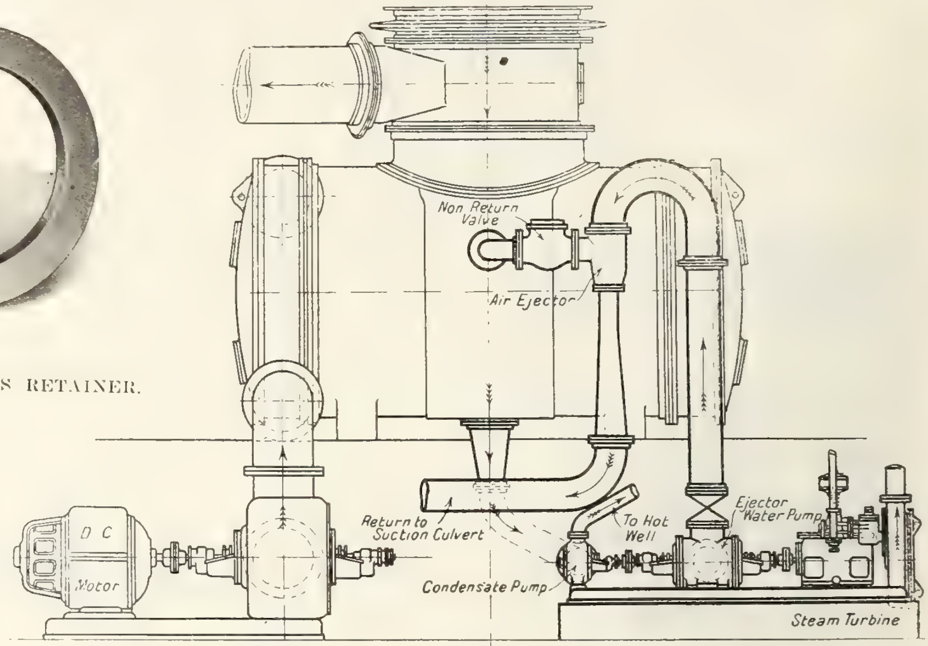
BALL THRUST BEARING WITH SOLID BRASS RETAINER.

TEST OF A LARGE SURFACE CONDENSER

SOME test results obtained on one of five surface condensing plants, embodying a rotary air pump system, designed by Willans & Robinson, Rugby, England, and recently installed at the London & South Western Railway Co.'s Durnsford road power station, have now been made available. The station contains five identical plants, all of the same capacity, in addition to two small similar plants; all of them operate on the same principle.

The main feature of the system is that the circulating water is passed through an ejector, shown in the accompanying cut, which takes the place of the ordinary air pump. A separate condensate pump is provided to withdraw the condensed steam from the surface condenser, and to return it to the hot well. An automatic non-return valve is placed between the air ejector and the main condenser body so as to prevent water being drawn into the condenser in case of failure of the ejector. There are three common forms of application of the system, known as the "series," the "shunt," and the "separate pump" types respectively.

In the case of the "series" type of plant, the whole body of the circulating water is passed through the air ejector before it enters the condenser—that is to say, the circulating pump is designed for the normal quantity of water required by the condenser, but allowance is made in calculating the head for the necessary drop across the air ejector. In the case of the second or "shunt" system, the cooling water for the condenser and the ejector water are delivered in parallel and the ejector water is returned to source of supply or to circulating water suction. In other words, the circulating pump is designed for the normal head required by the lay-out of the plant, with allowance for condenser friction, and the quantity delivered is that needed for the condenser itself, plus the necessary water for the air ejector. The third, or "separate pump" type, of which the London & South-Western installation is an example, differs from the "shunt" system only in that a separate pump is provided for delivering the air ejector water, as apart from the main circulating water pump, which supplies the condenser in the ordinary way.



ARRANGEMENT OF CONDENSING PLANT AS TESTED.

In the present installation, both the main circulating pump and the ejector pump draw their water by means of a common suction pipe from the main suction culvert, which runs the full length of the engine-room. The water coming from the condenser itself is, of course, heated and passed to the delivery culvert, but the air ejector water is returned to the suction or inlet culvert. It will be noted that in this instance the circulating pump is driven by means of a continuous-current motor, whereas the ejector pump and condensate extraction pump drive is by small steam turbine.

The tests were carried out in the presence of the representatives of the consulting engineers, Messrs. Kennedy and Donkin, and of Herbert Jones, chief electrical engineer to the London & South-Western Railway Company. It will be noted that the vacuum attained is substantially above that guaranteed, and the makers draw particular attention to the low difference between the circulating water outlet and vacuum temperatures.

Trial number	I.	II.	Guarantees
Duration of test	60 min.	60 min.	
Load, pounds of steam per hour	68,176	68,389	68,000
Vacuum at steam inlet to condenser, corrected to 30 in. barometer	28.73in.	28.76in.	28.5in.
Corresponding steam temperature	86.6° F.	86° F.	92° F.
Condensate temperature	82° F.	82.5° F.	87° F.
Difference between condensate and vacuum temperatures	4.6° F.	3.5° F.	5° F.
Circulating water inlet temperature	58.5° F.	58.5° F.	65° F.
Circulating water outlet temperature	80.8° F.	81.1° F.	83° F.
Difference between circulating water outlet and vacuum temperatures	5.8° F.	4.9° F.	9° F.
Cooling water, gallons per hour	318,000	317,600	396,600

Note.—The test was carried out after the plant had been in service for a considerable period.

ASSUMING that an average of one million shells fired per week on one of the great European battlefields is a not excessive calculation, a contemporary estimates that during thirty weeks which one conflict lasted, 1,300,000 tons of steel were fired. An area of 100 square miles figures out at 20 tons of scrap per acre, which at a value of $12 per ton would yield a harvest of $240 per acre. This is on shell steel alone, and does not include wire, copper, etc., which which considerably enhance these values.

Steam Saving Auxiliaries of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that steam-driven auxiliaries aboard ship continue to increase in number, and that they are being designed and constructed to meet, in the most effective manner, both ordinary and special service applications, this series of articles describing and illustrating at least the more important types of such apparatus seems to us more or less timely, both from the point of view of familiarizing engine and boiler room staffs with the products of different manufacturers, and that of their acquiring a closer intimacy with specific detail arrangement, relative to operation, maintenance and periodic overhaul.

FEED WATER HEATERS—II.

IN the previous article of this series, dealing with feed water heaters, an outline was given of the principal types of heaters in general use, as also the principles of construction which govern their adaptability to varying circumstances. Without in any way detracting from the merits of the closed type and its suitability under certain conditions, the superior economy of the open type under the majority of ordinary conditions has led to its widespread adoption, since in the open heater the steam comes into actual direct contact with the water to be heated, so that the transmission of heat is immediate, allowing the water to be brought up to the full temperature of the steam. The spraying of the water through the steam bath also has the effect of driving off air and other gases held in solution, thereby reducing corrosion in the piping and boilers, and facilitating the precipitation of scale-forming substances.

Cochrane Open Feed-Water Heater.

Two principal types of Cochrane heaters are made, being built and marketed by Canadian Allis-Chalmers, Toronto. One of these types exhausts freely to the atmosphere, being known as open feed-

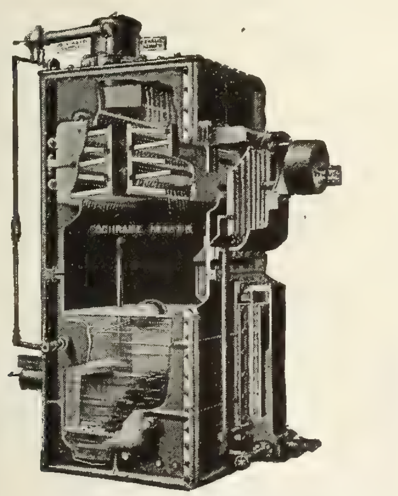


FIG. 5. COCHRANE OPEN FEED WATER HEATER FOR ENGINES EXHAUSTING INTO ATMOSPHERE.

water heaters, while the other type is for use with engines that furnish exhaust steam for heating or drying systems, and is known as the Cochrane feed-water heater and receiver.

As the exhaust steam is condensed and becomes a part of the feed water, it is vitally important, as already pointed out, that an open heater be protected by an efficient oil separator. In these heaters (see Figs. 5 and 6) the separator is attached to, and forms part of the heater, and consists of a vertical baffle placed in the path of the entering steam, to intercept the incoming oil and water carried by the exhaust, and provided with ribs to prevent the current of steam scrubbing the oil off again in its passage around the baffle. The water and oil separated from the incoming steam drain into a trap or water seal. In heaters intended for use in connection with engines exhausting freely to atmosphere, that is, without back pressure, this trap takes the form of a plain water seal of sufficient height to prevent the escape of exhaust steam to the waste connection. The same water seal communicates with an overflow weir within the body of the heater. The purpose of this weir is twofold—first, to permit of periodically skimming the surface of the water in the heater, and second, to make impossible any rise of water level above a fixed point, thereby protecting the engines against water being drawn back through the exhaust pipe.

Cochrane heaters and receivers are distinguished from the heater just described in that the plain water seal is replaced by a float trap. Where this type of heater is installed—that is, where the engines, pumps, etc., exhaust against back pressure, steam is generally employed for other purposes, as in radiators, heating and drying coils, steam jackets, calendering rolls, low pressure turbines, absorption ice machines, etc., and in order that such steam after condensation may be returned to the feed-water heater and used for boiler feeding, an oil separator should be installed in the exhaust line, together with a trap for draining it.

In the Cochrane steam-stack and cut-out valve heater and receiver the separator on the heater is made of sufficient capacity to purify all the exhaust steam, including that passing to the heating system, thus saving the expense, complication and space incidental to an independent separator in a by-pass. To permit of cutting the body of the heater out of circuit for inspection or cleaning while the heating system is in operation, valves are incorporated in the design between the separator and the heater, and between the trap which drains the separator and the heater overflow. When these valves are closed and the operating handle removed, the heater may be opened without fear of steam being turned in. The valve in the separator is held to its seat by springs, which is a valuable safety feature, since it prevents accumulation of pressure in the heater body when the latter is cut off from the main circuit, as by the discharge of live steam traps or other high pressure steam direct into the heater.

Cold Water Admission

The admission of cold water to Cochrane heaters is controlled by a float, which operates a regulating valve in the make-up supply connection. The heater thus takes the place of an automatic make-up water regulator. The cold water is delivered into a trough in the top of the heater, from which it overflows upon serrated trays. Condensed returns may be delivered either into this trough or into a separate returns trough, depending upon their temperature—that is, whether or not they require to be heated. Due to the automatic control of the make-up water, the heater performs the duties of an automatic make-up water regulator, and by serving as a receptacle for all drips, condensate, etc., suitable for boiler feeding, it takes the place of a hot well or returns tank.

As all feed water supplies are brought together before being finally pumped in-

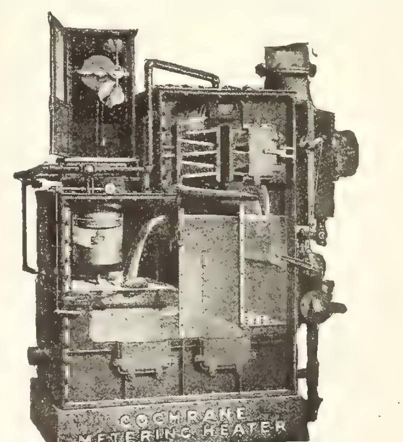


FIG. 6. COCHRANE METERING HEATER.

to the boiler, an opportunity is offered for their measurement, and a recent modification of the Cochrane heater, known as the Cochrane Metering Heater, provides for this, by the incorporation of a V-notch weir and a suitable approach passage and outflow chamber for the latter (see Fig. 6). This weir is incorporated within the heater struc-

ture, under the same pressure that exists in the latter, thus avoiding any possibility of complication due to rapid fluctuations in steam pressure, such as frequently occur where the exhaust is intermittent or the supply of cold water is variable.

By accurately measuring the feed water, the metering heater makes it possible to determine the evaporation, also to ascertain the values of different grades of coal, different methods of firing, the effects of cleaning soot and scale off tubes, and hence the frequency with which these operations should be performed, besides benefits from stopping up air leaks in the boiler setting, changes in the grates or methods of firing, etc. Once the most favorable conditions and the maximum evaporation which they will give have been ascertained, the metering heater serves to show by its record whether these favorable results are being realized in regular operation.

Water Softening Apparatus

In a preceding paragraph the fact is mentioned that the heating of the water by spraying through a steam bath accomplishes more or less purification, due to the escape of air and other gases. Advantage has been taken of this, and of the further fact that chemical reactions are much more rapid and complete in hot water than in cold water, in the Sorge-Cochrane hot process water softener, which in addition to a Cochrane open heater, also provides for the accurate treating of the water with softening reagents, and for the subsequent removal of the precipitates before the water passes to the boiler. The use of both heat and the proper chemical treatment makes possible a great advance in water softening practice—that is, whereas with the cold process a reduction to three grains per gallon on scale-forming substances was the best to be guaranteed, with the hot process it is frequently possible to reduce the scale-forming solids to half this amount, and in some cases to less than one grain per gallon.

All forms of Cochrane heaters, with the exception of the Sorge-Cochrane hot process softener just described, are constructed throughout of heavy cast iron plates, which because of their thickness and resistance to corrosion are more durable than steel plate. The heater body may be of the rectangular form, or where large capacity is required and low headroom, the horizontal cylindrical type of heater is provided. Where a very large water storage capacity is required, as in the softeners, and also in special heaters designed for supplying and storing hot water for industrial purposes, the storage chamber may be of either steel plate or cast iron, depending upon local conditions.

Massillon Open Heater

This heater is illustrated in Fig. 7, which shows the principal features of construction, such as accessible cast iron trays, non-stick plug steam cut-out, large oil separator, ample water seal, upward filtration through large filter bed, absence of internal holding bolts, and quick opening pump suction by-pass.

It is built by the Canadian Griscom-Russell Co., Montreal, and consists of a cylindrical cast iron shell containing all the various devices necessary for purifying, controlling and heating boiler feed water. The metal used for the shell trays and other parts in contact with the raw-feed water is cast iron, on account of its durability and resistance to corrosion. A generous area of surface for receiving deposited scale and mud is provided by a series of trays of cast iron on simple and strong form. These trays may be readily slid in and out of place, being designed so that even the presence of large quantities of scale cannot interfere with easy removal for cleaning as often as necessary. In the upper portion of the heater shell is a large opening closed by a convenient door, giving ready access to the trays and to the interior of the heater.

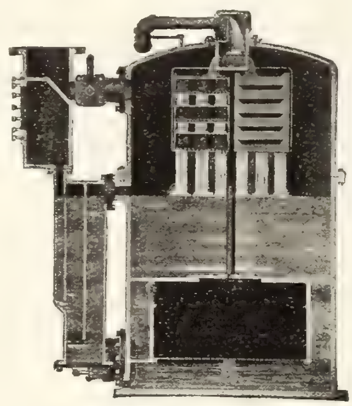


FIG. 7. SECTIONAL VIEW OF MASSILLON OPEN FEED WATER HEATER.

The space immediately below the trays is utilized as storage for feed-water, previously heated and cleared of all solid matter in its passage over the trays. The level of water in the storage space is maintained by a float, connected to the feed-water inlet valve. The supply of make-up feed water is thus regulated automatically by the feed pump. An overflow opening with skimming edge is provided to remove floating material and scum.

Filter Arrangement

The feed-water storage is divided by a horizontal cast iron plate, through which a passage leads the water to a settling chamber at the bottom of the heater. From the settling chamber the water filters upward through a filtering chamber containing coke supported on a perforated plate. Above the filter the water passes into a storage space from which the feed pump draws.

The positive cut-out valve previously mentioned permits the heating steam being shut off from the heater, and allows access to the interior for cleaning without shutting down the plant. This valve is positively operated, and is similar in design to boiler blow-down plug cocks.

Oil Separator

A baffle plate type oil separator is employed, through which all the exhaust steam is passed and effectively cleared of oil and drip water. From the separator a suitable opening automatically admits the required quantity of steam to the heater. A vertical opening on top of the separator provides for an open-air exhaust pipe connection, through which the excess of exhaust steam can flow to the atmosphere without passing through the heater.

The upward flow filter, as adopted in this case, is an important feature. It is evident that mud and suspended substances in the feed-water tend to deposit themselves on the floor of the large settling chamber below the filter. Any finer particles carried upward by the current of water are intercepted by the lower layers of the coke in the filter, and cannot easily penetrate far into the body of coke. For this reason the coke filter can be readily cleared of sediment by merely drawing off the water from the bottom of the heater. The reversed current set up by the water contained in the chamber above the coke tends to wash the filters clear of all impurities.

The filter is easily reached through a large door provided in the side of the heater shell. By swinging back this door on its hinged bolts, the coke can be easily shoveled out of the heater and all parts of the filtering chamber reached.

Operating Features

A by-pass is provided in case of emergency, by which through the simple opening of the valve, the entire body of water in the heater can be made instantly available for feeding the boiler without first passing through the filter.

A large water seal is provided to permit carrying one-half pound back pressure on the heater without the added expense of a trap. For higher pressures the heater can be equipped with a special overflow trap operating independently of variations in the exhaust back pressure. This trap is float-actuated and operates to open the overflow whenever an excess of water running over the skimming dam reaches the trap. The drain from the oil separator is connected with the same trap.

LAKE CARRIERS' ASSOCIATION REPORT

SEVENTY-THREE lives and 14 vessels were lost on the Great Lakes during the season of 1916, according to the annual report of the Lake Carriers' Association made public on January 18, at the annual convention of the organization. This heavy casualty record is the most serious since 1913, when a fearful November storm claimed the greatest toll of lives and of ships in the history of inland navigation.

Three wrecks last year caused the death of 67 seamen. The first serious casualty took place on May 8, when the steamer S. R. Kirby went down in a gale on Lake Superior, off Eagle Harbor. Only two members of her crew of 22

were saved. The other two boats sank in Lake Erie on October 20. Twenty-four men went down with the whaleback James R. Colgate, and the steamer Merida was lost with her entire crew of 23 persons.

The gross tonnage of the 14 ill-fated vessels was 16,817. The remainder of the boats recorded in the casualty list follow:

Steamers: City of Midland, Panther, Topeka, Saronic, St. Ignace, Roberval, Marshall F. Butters.

Barges: Rob Roy, D. L. Filer, Sam Flint.

Schooners: James H. Hill.

The tremendous business handled last year by lake vessels is emphasized by the report which declares "that the ore movement in 1916 was 64,734,198 tons, as against 49,070,478 tons in the hitherto banner year of 1913." The report adds, however, that although contract ore rates were increased 10 cents a ton last year, "the boats made very little money," because "operating expenses were so greatly increased." It is said, however, that "the outlook for 1917 is roseate."

The Great Lakes grain trade in 1916 totalled 363,999,156 bushels, a decrease of 22,166,896 bushels from 1915. The report adds that the grain rates were the most "significant features of the year's trade," as the average rate per bushel for the season was 4¼ cents, compared with 2¼ cents the preceding year.

The record breaking demand for ocean and coastwise vessels was responsible for the greatest buying campaign in lake history. Seventy-one vessels, with a total tonnage of 683,770 gross were disposed of and the list included 12 ore carriers of the 10,000 ton class.

Most of the vessels built last year were big freighters. Six, 12,000 ton steamers were turned out, while one 9,500 ton boat and one of 7,000 tons were built. Fifty-nine vessels are under construction at Great Lake ports for 1917 delivery.

WORLD SHIPBUILDING DURING 1916.

THE outstanding features of the world shipbuilding statistics for 1916, are the decrease in production in the United Kingdom and the great activity in the United States. British shipyards have been so busily employed on naval work that they have done even less merchant work than in 1915, while shipbuilders in the United States have been experiencing a great boom in new contracts, many of them from neutral countries who were good customers of the United Kingdom in pre-war years.

The English, Scottish, and Irish production consisted of 412 merchant vessels of 582,305 tons and 410,281 i.h.p., compared with 517 vessels of 649,336 tons and 540,594 i.h.p. in the previous year—a decrease of 105 vessels, 67,031 tons, and 130,313 i.h.p. It is however, necessary to go farther back than one year in order to find how the work compares with that of normal times. It is less by 882 vessels, 1,139,849 tons, and 956,553 i.h.p. than that of 1914—in which five months of the year was disturbed by the war.

Warship tonnage and all other tonnage built to the order of the British or Allied Governments is excluded from these figures, and the general result is that in 1916 there was launched about one-third of the tonnage of 1914. Going back to the purely mercantile output of 1913, we find United Kingdom totals of 1424 vessels, 1,977,573 tons, and 1,556,560 i.h.p.—not far short of four times those of 1916.

These comparisons are eloquent of two things—(1)—The amount of work of a non-mercantile character that has been done, and (2), the amount of reserve power that will be released in British shipbuilding when the war is over. It would, the writer continues, certainly be a great mistake to infer that they indicate any falling off in producing capacity. Behind them there is a period of unprecedented activity, works extensions, and improvements in plant and in organization that will be invaluable assets to the industry when the war is over, and experience which has proved that those who thought that British shipbuilding had come in 1914 within sight of its limit in productive power had very little idea of what it could really do.

In the foreign production there is an increase from 989,337 tons to 1,335,791 tons. This increase is accounted for almost wholly by the work done in America and Japan. In the United States the production was more than double that of 1915, while from every district there came reports of many contracts and extreme activity. The yards on the Great Lakes did a large amount of work, whereas in 1915 they had a very low tonnage to their credit. In Japan the total was almost three times that of 1915, the increase being accounted for principally by the construction of a good many large cargo steamers. In Holland, shipbuilders were working under exceptional difficulties, and one firm stated in their report that, owing to the increasing difficulty of obtaining materials, stagnation in their industry was threatened. There were few reports of launches in Germany, and in other Continental countries there were no features of outstanding interest.

TRANS-ATLANTIC TRADE OF MONTREAL

ACCORDING to the annual report of Captain T. Bourassa, harbor master of Montreal, submitted to the Board of Harbor Commissioners, more trans-Atlantic vessels arrived there in 1916 than during any previous year, and, but for the fact that there was a considerable falling off in the number of vessels from the Maritime Provinces, the total tonnage would have practically equalled last year's figures. The report gives comparative statistics since 1907, the grand total showing that last year 7,995 vessels had a total tonnage of 5,693,328 tons as compared with 9,387 vessels and 6,483,800 tons in 1915. There were 202 fewer vessels from the Maritime Provinces—or a falling off of over 400,000 tons. The following statistics are taken from the report:—

Year	Vessels	Tonnage
1907	15,161	5,546,936
1908	13,173	5,548,028
1909	11,661	5,057,907
1910	14,383	6,561,021
1911	12,432	6,613,271
1912	13,322	7,053,691
1913	14,246	8,394,002
1914	13,141	9,044,457
1915	9,287	6,483,800
1916	7,995	5,693,328

Following is a comparison of the number and tonnage of trans-Atlantic vessels since 1912:—

Year	Vessels	Tonnage
1912	409	1,775,487
1913	477	2,020,333
1914	551	2,039,133
1915	484	1,657,728
1916	569	1,965,161

The following figures give particulars as to nationality of vessels arriving here during 1916:—

Nationality	Number	Tonnage
British	650	2,030,240
Italian	13	52,392
Norwegian	13	22,914
American	18	19,731
Danish	3	4,642
French	1	4,537
Total		2,134,456

BOARD OF TRADE FORMULA FOR NOMINAL HORSE-POWER

RECENT "Instructions to Surveyors," issued by the Marine Department of the British Board of Trade contain particulars of an alteration which has been made in the formula to be used by surveyors for determining the nominal horse-power of foreign-going steamships under Sec. 92 of the Merchant Shipping Act, 1894, when there is a doubt whether the nominal horse-power is over or under 100. The present formula is:—

$$\text{N.H.P.} = \frac{S}{30}$$

Where S is the sum of the squares of the diameters in inches of all the cylinders.

The formula to be used in such cases in future is:—

$$\text{N.H.P.} = \frac{(3\,H + D^2\,\sqrt[3]{S})\,\sqrt[3]{P}}{700}$$

where H = heating surface of main boilers in square feet, measured down to the level of the fire-bars, but excluding the front tube plate.

D^2 = square of diameter of low-pressure cylinder, or sum of squares of diameters of cylinders in non-compound engines, measured in inches.

S = length of stroke of engines in inches.

P = pressure of main boilers in pounds per square inch.

Foreign-going steamships of 100 nominal horse-power or upwards are required to be provided with at least two certificated engineers.

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Vol. VII JANUARY, 1917 No. 1

PRINCIPAL CONTENTS

HIS MAJESTY'S CANADIAN TORPEDO BOAT "GRILSE"

IN our December issue, reference was made editorially and also through the medium of an illustrated article, to the specially trying experience from which His Majesty's Canadian Torpedo Boat "Grilse" and the majority of her crew had just emerged successfully. We have been asked by Lieut. J. K. L. Ross, R.N.C.V.R., former owner and commander of the vessel, and by whom with a commendable patriotism she was handed over to the Canadian Department of Naval Service, to state that the illustration which we published did not represent the "Grilse," also to correct some inaccuracies in the text matter. This we take pleasure in doing by publishing his letter which will be found on page 10 of our present issue.

The writer being familiar with the appearance of the vessel—having seen her "war dressed" on several occasions, has no hesitation in stating that the photograph received from Lieut. Ross, along with his letter, is more truly representative of the "Grilse" than that published previously by us. We, however, to avoid a possible clash with the Censor, did not positively identify the craft, the underline to the illustration having the qualification — "Speed Pleasure Yacht." Further, and to quote direct from our previous editorial, it was stated that—"to those unfamiliar with the appearance of the vessel, a **very good idea** is to be had from our illustration." Referring to Lieut. Ross' letter, and the survey report on the vessel, we may state that the name of the gentleman who furnished the latter has been given us. He is personally known to the writer and is well qualified to pronounce authoritatively on such craft as the "Grilse" and on war vessels generally, as well.

We are further advised by Lieut. Ross that during his twelve months' command of the "Grilse," "they were out in all weathers, and on one occasion he took her through a cyclonic storm near Bermuda, it being necessary then to keep to sea for nearly a full week. Nobody was hurt aboard and not a rivet was started. It was uncomfortable," he states, "as all destroyers are, but I always felt confident that the 'Grilse' would weather any storm if navigated carefully." The vessel is over 200 feet long, not 175 feet. She was built by Yarrow's Ltd., and not by Thorneycroft. Regarding her builders, for record purposes, the information is desirable; as indicative of high quality product—however, no distinction may be drawn between the two builders named, our views in this respect being clearly evident from the opening sentence of our previous editorial which we here quote: "The fact that H.M.C. torpedo boat Grilse managed to make port after being battered and bruised to the point of foundering with all aboard **is due in the first place to her soundness of construction at the hands of her builders,** and secondly to the herculean efforts of the crew to keep her afloat by hand pumping and baling, even when all hope of rescue seems to have faded."

Readers of our journal will appreciate Lieut. Ross' desire to put before them the facts bearing on the "Grilse" construction, transfer, and his own service as her commander, and will concur with us in the opinion that, so far as he is concerned, neither effort nor expense were spared in the performance of his patriotic act. We still think, however, that poor judgment was displayed by those in authority in putting the "Grilse" to sea—especially on the North Atlantic in mid-winter, and while we do not hesitate to stand alone in so expressing ourselves, we are pleased to state that we have the unqualified support of perhaps the most prominent authority on light craft construction and exponent of their navigation on this continent.

We should have been pleased to publish the photograph of the "Grilse" in her "war dress," but the Censor is unrelenting. Lieut. Ross fully appreciates the situation in this respect, as will also our readers.

Marine News From Every Source

Vancouver, B.C.—The general contract for the construction of an extension to the C.P.R. Co's. Pier "D," has been let to S. E. Junkins and Co., Vancouver.

Marine Insurance Raised.—The *Daily News*, London, England, says that owing to the increased submarine menace, the Government War Risk Insurance Office has raised the insurance rate per voyage for British vessels to forty shillings per cent.

Victoria, B.C.—The auxiliary schooner Margaret Haney, which is being built by the Cameron Genoa Mills Shipbuilders, Ltd., will be launched about the end of January. The 160 h.p. Bollinder engines will be installed after the vessel has been launched.

Port Arthur Shipbuilding Co. has been incorporated at Toronto, with a capital of $2,500,000, to take over the business of the Western Dry Dock and Shipbuilding Co., of Port Arthur, Ont. The provisional directors are: Donald R. Hossack, John G. Leckie, and Lorne L. Lillico, all of Toronto.

Halifax, N.S.—While the ocean tugs Roebling and Lisgar were towing the Canadian Government dredge Cape Breton and two scows from Lunenburg to Louisburg on Jan. 17, a heavy gale sprang up off Whitehead. The dredge broke adrift, went ashore and the captain and crew numbering nine, perished.

North Vancouver, B.C.—A graving dock will be built on the western portion of the Wallace No. 2 Shipyard, between Bewicke and Pemberton Avenues, and boring work is proceeding satisfactorily to determine its most satisfactory location. A representative of one of the leading Eastern engineering firms is at present looking over the preliminary work.

St. John, N.B.—The Eastern Steamship Corporation fleet of steamers, docks and warehouses, etc., have been purchased by Hayden, Stone & Co., of Boston, on behalf of a syndicate, who will reorganize the corporation. The price paid was $3,366,000, which includes a large interest in the Boston and Yarmouth Steamship Co.

Lake Lines to Raise Rates.—The International Water Lines Passenger Association, at its convention held at Quebec recently, decided to raise the passenger traffic rates on the Great Lakes, and certain rivers in the United States, as well as in Canada, but the Canada Steamship Lines, Ltd., announce they will not raise their rates on the St. Lawrence to the Saguenay River.

Yacht "Florence" Sold.—The steam yacht Florence, formerly owned by Sir John Eaton, of Toronto, and since the war began in the service of the Canadian Government as a patrol and scout vessel, has been sold to the French Trading Co., of Martinique, F.W.I. It is understood she will be used by her present owners for commercial purposes. She has left for Fort de France, Martinique.

Shipbuilding Bounties.—From a note in a recent issue of the *Board of Trade Journal*, we gather that a new Shipbuilding Act for Newfoundland provides for payments to be made to shipbuilding concerns situated in the colony. These payments take the form of making up the net annual profits of 7 per cent. for a term of 15 years should they be below this figure. The Act also provides for free importation of materials for the equipment of shipyards as well as of those used in shipbuilding. Furthermore, the tonnage bounties under the Act of 1908 are to be doubled.

1916 Lakes Season.—The lake marine season of 1916 will be known as the longest on record, boats encountering ice at the start and finish. Thirteen vessels passed out of existence during the nine months of navigation, but most of them were small and only two were lost in collisions. Two boats stranded and were total losses; three were destroyed by fire, and six foundered. Four of the lost vessels went down in the gale which swept Lake Erie on Oct. 20, and the steamer "Merida," which went down with all hands, was the biggest monetary loss. She was insured for $200,000. The loss on the S. R. Kirby, which went down in Lake Superior early in the summer, was the next greatest loss. She cost the underwriters $120,000. Total loss of life was 70, as against 15 the year previous.

Montreal, Que.—It is understood that important additions will be made to the Canadian Vickers plant here. The extensions will consist of two covered building berths, which, when completed, will double the ship-building accommodation already provided. At present the company has one large berth capable of taking a vessel 600 feet long. The dimensions of one of the new sheds will be 500 feet long and 128 feet wide, and the other will have a length of 400 feet and a width of 100 feet. The sheds will provide for the building of vessels up to approximately 12,000 tons. A commencement has already been made on this new work, which it is anticipated will be completed in March of next year.

Motor Ship Contracts.—Before this month end announcement is likely to be made that the Dominion Government has let the contract for two motor ships of wooden construction, similar in type to those now being built in British Columbia for merchant trade. The Government has had the proposal under consideration since the return of Hon. Dr. Reid to Ottawa. A statement was made public shortly after the visit of the Minister of Customs to Vancouver, that this was a possible solution of the problem of transportation from the Atlantic seaboard to Vancouver via the Panama Canal.

Japanese Shipbuilding.—Some idea of Japanese shipbuilding activity may be gained from the fact that in the past eight months one hundred and twenty thousand tons of new steamships have been launched. During the five years prior to the outbreak of the European War only forty-nine thousand tons of steamships were built annually in Japan, which, compared with the present figures, is about one-third of the past eight months' output. Before the war Japan used to purchase about one hundred thousand tons of steamships every year from abroad.

Lack of Ocean Tonnage.—Lack of ocean tonnage may prevent the shipment of the fifteen hundred miles of steel rails which the Canadian Government undertook to supply for use in France. Canada is providing the rails, and, if the British Government can get them across the ocean, the arrangement entered into two weeks ago will be carried out. The tonnage now available, however, is insufficient, and if no more is forthcoming the rails can hardly be transported with the expedition that is necessary. Three hundred miles of steel from the Government railways are going across at once. If the rest cannot be taken over in time it is assumed that steel mills in Great Britain will be used to turn out what is required.

Subsidized Shipbuilding Advocated.—Donald Nicholson, M.P., in a paper on shipping and shipbuilding, read before the Charlottetown, Prince Edward Island, Board of Trade recently, advocated bonusing or subsidizing, for a number of years, shipbuilders in order to encourage the building of small wooden vessels of from forty to a hundred tons, as there is

sufficient lumber on the island to maintain a considerable industry. Nicholson's colleague, A. A. McLean, M.P., did not think wooden shipbuilding was practicable, but advocated steel shipbuilding. It was announced that preparations were now under way to build three 300-ton schooners on the Island at a cost of $20,-000 each. No vessel was built there last year. There are 130 sailing vessels with a gross tonnage of 8,400 and 28 steamers of 7,571 tons on the Island registry list.

ROYAL NAVAL CANADIAN VOLUNTEER RESERVE.

RECRUITING for the R.N.C.V.R. is now in progress all over Canada. In Toronto some 400 men have joined, and the recruiting station in the Jarvis Building on Bay street is generally alive with ready-to-be seamen in their natty uniforms.

As part of Canada's contribution of 500,000 men for overseas, the Dominion Naval Department has organized the Royal Naval Canadian Volunteer Reserve in which Canadians can serve the Empire afloat at the same rates of pay as in the Canadian Expeditionary Forces. Men enlisting in this reserve are ranked as able seamen and are paid $1.10 per day, with $20 per month separation allowance to wife or dependents. Previous sea experience is unnecessary—men who are physically fit and between the ages of eighteen and thirty-eight, even if they have never seen the sea, are given the privilege of joining the navy at full seaman's rank at a wage much in excess of that paid the regular British navy seaman.

The Outfit.

The naval seaman upon enlistment receives a full kit of clothes consisting of two cloth caps, one white duck cap and cap covers, three duck working jumpers, two duck uniform jumpers, two serge jumpers without cuffs, two jerseys, two check shirts, two pairs drawers, four pairs duck trousers, three pair serge trousers, two pairs socks, one pair shoes, one pair boots, three blue jean collars, three flannels, two night shirts, two handkerchiefs and one silk handkerchief, two bed covers, one comforter, hammock, knife, blacking brushes, clothes brush, hair brush, scissors, soap bag, "housewife," comb, toothbrush, cap boxes, prayer book, overalls, lanyards, etc., the whole being stowed in a brown canvas kitbag—the bedding excepted, which is lashed up in the hammock. Each seaman receives two hammocks. Oilskins, seaboots and watch coats are issued to those men on duties which require them. A stock of ready-made clothing is kept in the naval depots and aboard many ships and issued to the men when necessary to replace lost or worn-out kit.

At the training school, the R.N.C.V.R. man receives instruction in the rudiments of naval drill and discipline; is taught the distinguishing ranks and flags; how to look after his kit and lash his hammock, and is given at least two months' preliminary instruction in rifle and bayonet drill, foot drill and as much knowledge of seamanship as can be given ashore, and a general idea of signalling, naval gunnery and torpedo work.

When considered competent enough, the naval seaman is drafted to a man-of-war and entered on her watch bill. A card is given him which details him to his mess in one or other of the various departments of forecastle men, foretop men, maintop men, or quarterdeck men, and in either the port or starboard watch and the subdivisions thereof. In his particular watch or subdivision he is given details as to his position in event of collision, torpedo attack, outbreak of fire, going into action, or abandoning ship. Each of these manoeuvres calls for different duties, and at sea he will receive his training in them.

In addition to these special duties, there is the daily round of work which runs something as follows: At 5.30 each morning the boatswain's and ship's corporals call the men. The seamen turn out, have a wash, lash up their hammocks and bedding and stow them away. Hot cocoa is served out from the galleys, and at 6 o'clock both the port and starboard watches fall in on the upper deck, and the deck sweepers are told off to sweep the upper decks. Hoses are rigged, buckets and brooms served out, and the work of washing down decks begins. Cleaning the guns and scrubbing decks in the fresh morning air soon works up an appetite and when the work is finished at seven o'clock, the call for breakfast is sounded. One hour is allowed for breakfast, cleaning up and changing into the "rig of the day," i.e., the clothes for the particular work the seaman is assigned to. Shortly before nine o'clock the men fall in on deck, the bugler blows "Attention," the marines present arms, and the sailors stand at the salute while the white ensign is hoisted and the ship's band, if carried, plays "God Save the King." In summer, this ceremony is carried out at 8 a.m.

Routine Work

Ten minutes later "Divisions" is sounded by the bugler, and the entire ship's company muster in their respective groups and divisions and under their particular officers. The names are called off by the various watch officers, and the men are inspected. After divisions, the crew march aft for prayers, which is followed by fifteen minutes' physical drill, then the routine work of the day commences. Parties are told off for painting, overhauling gear and rigging, etc. If the ship is at sea, certain men have their watches at wheel, look-out, and signalling—the others, outside of the working parties, are being exercised and instructed in the arts of naval warfare at the guns, torpedo tubes, small arms, and manoeuvres of offence and defence.

At noon, all hands are piped to dinner, and at 1.10 p.m., decks are cleared, and work commences again at 1.25 p.m., and continues until 4 p.m., when decks are cleared up ready for the evening muster at 4.15 p.m., after which the men go to tea. There is no work after this except necessary watch duties. Supper is served at 7 p.m., and at 10 p.m. every man not on duty is supposed to be in his hammock. Saturday afternoon is generally a half holiday, and on Sunday nothing but necessary work is done.

SHIPBUILDING OUTLOOK

By John S. Leitch.*

THE prospects for Canadian shipbuilding are bright, and will be bright just as long as British shipbuilders have enough work on hand to keep them from entering into competition. As soon as they overtake part of the arrears caused through the loss of so many ships submarined, then there will be no hope of the Canadian shipbuilder getting orders in the open market. From the latest reports, the building of a great many merchant ships is now being undertaken in Great Britain, and, while the loss of tonnage has been enormous, the facilities for quick output there are also enormous. The only way the Canadian shipbuilding industry can live after normal or nearly normal conditions prevail will be through some form of Government aid, which has always been necessary, and will be more so in the near future.

Shipbuilders all over are experiencing the greatest difficulty in securing steel, and the necessary labor to construct ships. The outlook for material particularly is not very promising, as the great demand on the steel plants for munitions steel is almost enough to keep them running to capacity, and until this demand slackens it will be difficult to get any thing like reasonable deliveries or prices. At the present time steel in Great Britain costs considerably less than what Canadian shipbuilders pay, and while the cost of labor has gone up considerably in the Old Country, it has not gone up to such an extent as over here. Inquiries are numerous, and those shipbuilders who are fortunate enough to get material and labor in sufficient quantities will, no doubt, secure abundance of work for the next four or five years.

A great deal has been written and published in the press recently re Canadian Order-in-Council regarding the 99 per cent. drawback of the duty paid on materials entering into ships, and the general impression is that this will be a great help in building up the shipbuilding industry. The people who have already written on this subject are evidently not intimately acquainted with the matter, as the relief afforded by this drawback is not of so much importance as might appear on the surface, and would only amount to a very small proportion of the cost in present-day vessels.

*Manager, Collingwood Shipbuilding Co., Collingwood, Ont.

LACHINE CANAL 1916 SEASON

IN the season of navigation of the Lachine Canal for 1916, extending from April 24 to December 15, the net cargo carried amounted to 3,265,022 tons, as against 3,265,294 tons for the season of 1915, both seasons being of 236 days duration. Thus, the amount of business in the two seasons has been practically identical, a fact which is all the more remarkable because a comparison of the items making up the respective grand totals of these two years show considerable differences.

The manner in which the balance and the routes of trade have shifted in the last few years is only less remarkable than the constancy of the total amount of business done. For example, only 585 vessels operated through the canal in 1916, as compared with 590 in 1915, but the total tonnage of these 585 vessels was 260,786, as against 249,050 net tons in 1915. The vessels operating last year made only 7,579 trips through the canal, a decrease of 241, and, in addition to this, 92 of the vessels with a total net tonage of 87,645 only passed through the canal on their way out to the ocean. Yet, with this handicap of only having 493 vessels with a total net tonnage of 173,141 constantly in the lake trade, this lessened tonnage, making fewer trips, managed to carry the same amount of cargo as in 1915. The grain carried was many millions of bushels below the previous year, but the coal carried was hundred of thousands of tons above the total brought down the canal in 1915. The tons of cargo carried up the canal aggregated over 100,000 tons less than in 1915, but the aggregate of cargo tonnage coming down the canal to the harbor exceeded last year by the same amount.

Opening and Closing Dates

The season opened and closed two days later than in 1915. The canal office was open night and day, Sundays and holidays included. The first grain vessel down was the steamer J. S. Keefe, from Chicago, on May 2, with 81,000 bushels corn, and the last grain vessel down was the steamer Easton, from Port Colborne on December 7, with 121,872 bushels oats. The last steam freighter west-bound was the steamer Sarnor on December 8. The barge J. G. Rene, of the Sincennes-McNaughton Line, left Waddington, N.Y., after discharging a cargo of pulpwood, to return to Montreal on December 13. She was taken to Cascades under tow of the tug Matilda, of the same company, and there on account of ice conditions in the canals this tug was reinforced by the Dupre, and the Rene passed into the harbor at 4.15 p.m. on December 15, thus closing the season of navigation.

American boats did a larger percentage of the canal business than in previous years. Comparing 1915 and 1916 respectively one finds that there was a decrease from 178 Canadian steamers of 123,309 net tonnage, to 144 of 84,050 net tons; that there was an increase from 46 American steamers of 52,651 net tonnage to 91 vessels of 95,356 net tons; that there was a decrease from 215 Canadian barges scows, etc., of 55,647 net tons to 194 of 54,308 tons, and that there was an increase from 6 American barges of 2,760 total net tonnage to 27 of 13,666. American canal boats showed a decrease from 145 of 14,683 net tons in 1915 to 129 of 13,406 tons in 1916.

Passengers Carried

The total combined tonnage for all the trips of boats through the canal was 4,001,173, as against 4,110,579 in 1915. The number of passengers carried totalled 69,172, an increase of 5,878 over 1915. Other tonnage statistics follow: Let passes issued, 4,376, a decrease of 444; lock masters' tickets up, 832, a decrease of 186; lock masters' tickets down, 2,242, a decrease of 318; permits to pleasure craft, 161, a decrease of 26.

Grain Carried

Although the amount of grain brought down in 1916 was only 25,168,452 bushels, 16,184,424 less than in 1915 every cereal carried showed an increase except wheat and flaxseed. The wheat brought down totalled 10,934,215 bushels, 19,509,463 less than in 1915, while the flaxseed carried amounted to 294,598 bushels, a decrease of 112,884. The other cereals showed the following increases over 1915: corn, 992,193 bushels, increase, 289,457; oats, 10,067,032 bushels, increase 1,567,997; barley, 2,502,914 bushels, increase, 1,226,104; and rye, 377,500, increase, 354,365 bushels. It may be added that the railroads brought wheat down in much larger quantities than usual.

Coal Carried

The most patent increase in cargo tonnage during the season was in coal, which advanced from the 1,070,138 tons carried in 1915 to 1,670,359 tons in 1916. Most of the coal came right down into the harbor, although half a million tons were unloaded in the canal basin, about 100,000 tons more than last year.

Pulpwood and Pulp

The pulpwood to Canadian ports decreased from 23,759 cords in 1915 to 16,116 cords in 1916, while that going up to American ports increased from 114,192 cords to 125,734 cords. This made a total increase from 137,951 cords in 1915 to 141,850 cords in 1916. It is interesting to note that 2,000 tons of pulp went to Canadian ports last year, while none went to American ports, as against 26,137 tons last year. This means a total tonnage of pulp of 62,117, an increase of 35,980 tons.

In produce the cargoes carried were smaller than usual. Only cheese showed an increase of 2,731 boxes in its aggregate total of 223,943 boxes. No flour came down, as against 123,273 sacks in 1915. Other decreases were: Cases of eggs, 12,622, decrease, 1,843; packages of butter, 4,529, decrease, 455; and barrels of apples, 90,090, decrease 16.041 barrels.

There were 2,851 trips made light for return cargoes in 1916, as against 2,942 in 1915, which means that the number of trips made by vessels which were cargo-laden amounted to 4,728, as compared with 4,878 in 1915.

The lumber brought down from the Ottawa River by American canal boats for American ports totalled 33,754,600 feet board measure, or 56,256 tons as against 27,728,400 feet, board measure, or 46,214 tons, in 1915. The decrease last year therefore, amounts to 3,973,800 feet, board measure.

Sand also showed in its total of 87,515 tons a decrease of 5,648 tons, as compared with 1915. The decrease was in sand going up the canal, only 22,961 tons being reported as against 48,297 tons in 1915. Sand coming down the canal, however, increased from 44,866 tons in 1915 to 64,554 tons in 1916.

SHIPBUILDING VIEWPOINT—III.

By James Whalen.*

THE prospective business future promises undoubtedly the best conditions under which we have ever operated, with the delivery of materials governing the general situation. With freight rates where they are now, shippers are hungry for vessels, the demand greatly exceeding the supply. As far as we can see, the situation will remain unchanged for many years to come, yet the effect on Canadian shipbuilding is problematical. With reasonable inducements, however, the shipbuilding industry should assume monster proportions. The meantime demand is for foreign ships, not for British or Canadian tonnage.

*President, Western Dry Dock & Shipbuilding, Port Arthur, Ont.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

W. G. Ross, chairman of the Montreal Harbor Commissioners, has been appointed director of naval recruiting in the Province of Quebec.

Capt. K. T. P. Woods, who spent many years at sea in the Monarch Line, out of Glasgow, Scotland, and for the past three years has been an officer on the cable ship, Restorer, has been appointed shore captain at Vancouver, B.C., for the Pacific Steamship Co.

P. V. G. Mitchell, manager of the White Star-Dominion Line, Montreal, has been appointed an honorary lieutenant-colonel. The appointment comes as a reward for Mr. Mitchell's services in connection with the transport of Canadian troops and supplies overseas.

William Phillips has been appointed by the Canada Steamship Line as their Canadian representative in the office of the Robert Reford Co., Montreal, general agents for Canada. Mr. Phillips was born in Toronto Jan. 31, 1870, and has had an extensive experience in railway and steamship business.

Bonus to Employees.—The directors of the Canada Steamship Lines have set aside a sum of $50,000 for the purpose of adding an acceptable bonus to the Christmas salary of all its permanent employees throughout the country. This is the first time such a generous Christmas fund has been provided for the employees of the company, and, in fact, the first time that such a fund has been provided at all. That it should have come is indicative of the cordial relations which have grown up among all sections of the company's services in late years.

Capt. H. N. McMaster, who came to Kingston from Toronto in the spring of 1913 as assistant marine superintendent of the Montreal Transportation Co., has now been appointed marine superintendent, filling the vacancy caused by the resignation of Capt. Robert Fraser, who went to California owing to ill-health.

Shipmasters Instal Officers.—The Toronto Lodge Shipmasters have elected the following officers:—President, Capt. O. W. Patterson; 1st vice-president, Capt. F. A. Cook; secretary-treasurer, Capt. Geo. Frewer; chaplain, Capt. Jefferies; marshall, Capt. Legandre; warden, Capt. C. Neice; sentinel, Capt. Ransom; delegates to Grand Lodge at Cleveland, Ohio, Jan. 25, Capt. J. E. Mann and Capt. W. J. Stitt.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. E. Mathews, Toronto. **Counsel**—F. King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B.; Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I. Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

MACHINE TOOLS ON BOARD SHIP

(Continued from page 10.)

complete with countershaft and hand power. A suitable engine (new or second-hand) would run to about $65, $75, $90 and $100, according to make and design. A "Pickering" or other quick-acting governor should be fitted to the engine. An electric motor and its gearing would probably run to similar figures.

To the cost of lathe and motive power must be added steam connections, piping, valves, etc.; or switches, cutouts, and wiring, together with any strengthening brackets, seating, etc., that various positions might make necessary, putting aboard, etc., which might run anything from or between $50 to $125—assuming that the actual fitting up was done by the engineers themselves. On the basis, therefore, of the above figures the value (when aboard) would run to about $315, $375, $475, and $575 for such lathes as I have mentioned. It is necessary to the proper consideration of such a subject that cost should be entered into, but my figures are entirely estimated and may be taken as "minimum."

One other item arises on the subject of a lathe on ship board, and that is material for its use. With an efficient lathe in an engine-room there would require to be bar iron and steel for studs, etc., brass castings for neck and gland bushes, muntz metal bars for pump studs, spindles and pins; some ingots of white metal and lead for liners and flanges. Breakages and repairs of the plant would be a question of the future; but I have stated sufficient to show that the pros and cons require due consideration.

1917 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand.	2378 Clark Street
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	Alfred Roebuck	22 Kent Street	Chas. Cumming,	27 Easton St.
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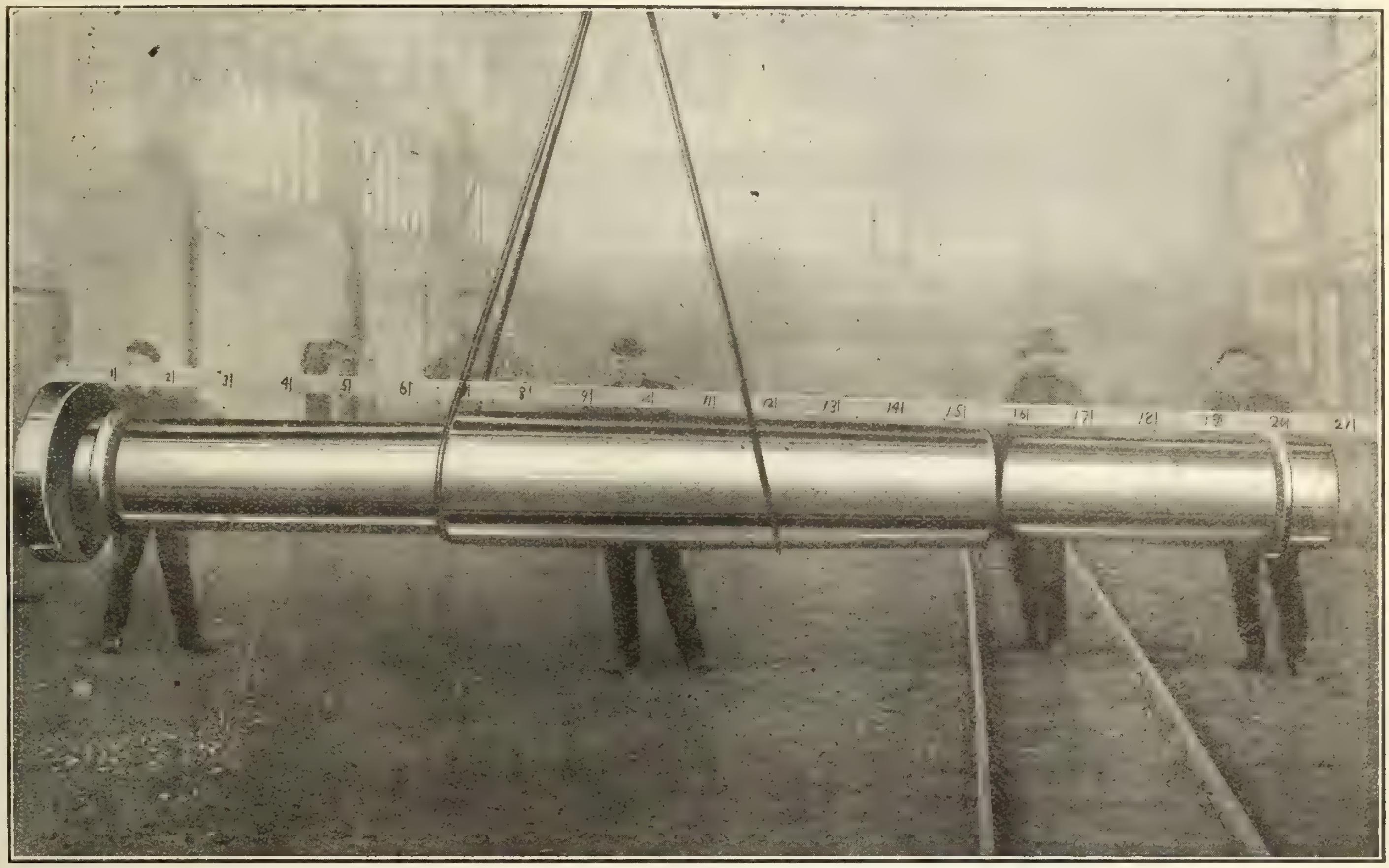

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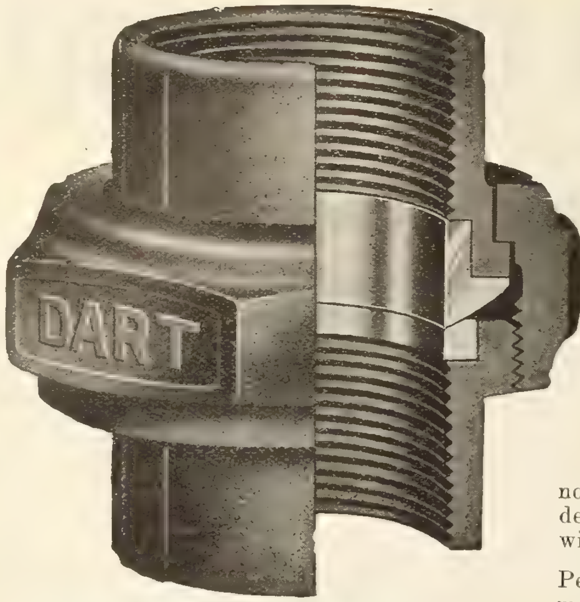

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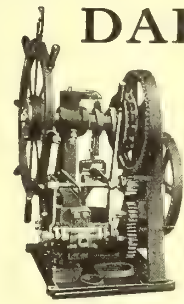

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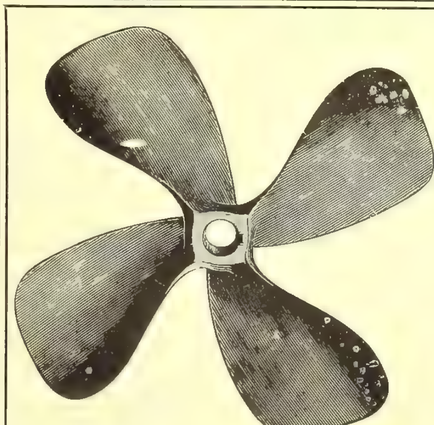

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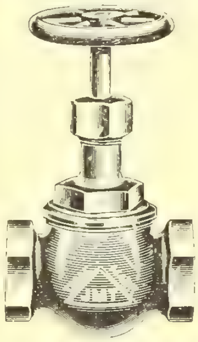

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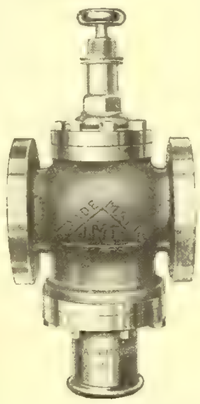

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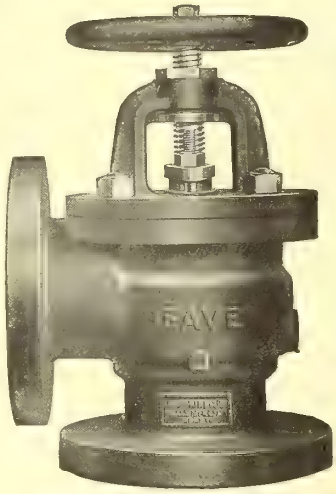
"Beaver" valves are designed for a working steam pressure of 250 lbs. per sq. inch and are subjected to a hydraulic test of 400 lbs. per sq. inch before leaving our factory.

We are prepared to furnish promptly any of the sizes listed on the following pages and guarantee the valves to fulfill in every respect all that we claim for them.

All of the wearing parts can be renewed, should they become worn or broken.



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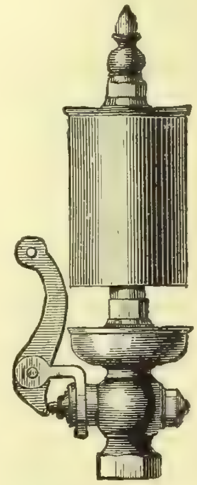

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Development of Ocean Service Shipbuilding in Canada--III.

By C. T. R.

In addition to the widespread requisitioning of vessels for transportation purposes by the Allies, the war attendant and normal merchant ship losses and the many months' almost complete cessation of new construction on the part of the latter, the merchant marine of neutral countries has had the misfortune to become to a large extent the target for enemy submarine activity. All nations have suffered in this respect, hence the almost feverish anxiety being displayed by shipping interests to have the losses made good at the earliest possible moment.

POWER SCHOONER "MARGARET HANEY" LAUNCHED

On Saturday, February 3, the auxiliary schooner Margaret Haney was successfully launched from the shipyard of the Cameron Genoa Mills, Shipbuilders, Ltd., Victoria, B.C., constituting the second of ten of her class on order to take the water since the inception of the new era of ship construction on our Pacific Coast. The first, the Mabel Brown, was launched from the Wallace Shipyards, North Vancouver, some time previously. Miss Isabel Elliott, daughter of R. T. Elliott, barrister, Victoria, christened the vessel, preceding and following which she was made the recipient of two large bouquets of flowers and a diamond necklace, respectively. The Canadian Genoa Shipbuilders, carry a contract for three similar schooners, two of which, the Laura Whalen and the Esquimault, are well advanced towards completion. The keel of the fourth vessel has been laid down on the berth vacated by the Margaret Haney.

The launching was under the supervision of Capt. Alexander Gow, marine superintendent for the Canada West Coast Navigation Co., for whom the ten schooners under construction at Victoria and North Vancouver are being built. J. H. Price and W. S. Taylor, president and manager of the Cemeron Genoa Mills Shipbuilders, Ltd., respectively, were, it is needless to say, delighted with the manner in which all the details of the function were carried out, and to them, as well as to the employees of the plant, much credit is due. The Margaret Haney is named after Mrs. Margaret J. Haney, wife of the president of the Home Bank of Canada. who is interested in the ownership of the concern.

List of Guests

Among the guests on the christening platform were Premier H. C. Brewster, Hon. M. A. Macdonald, Attorney-general; Hon. Ralph Smith, Minister of Finance; Hon. Dr. J. H. King, Minister of Public Works; H. B. Thomson, Superintendent of the Shipping Credit Commission; John Hart, M.P.P.; H. C. Hall, M.P.P.; H. W. Brown, manager for the owners; R. M. Wolvin, president of the Canada West Coast Navigation Co.; J. H. Price, president of the Cameron Genoa Mills Shipbuilders, Ltd.; W. S. Taylor, manager of the shipyard; Aldermen Cameron, Walker, Johns and Fullerton; City Engineer Rust, Capt. J. W. Troup, manager of the B. C. Coast Steamship Service; Capt. George McGregor, ex-reeve of Saanich; O. T. Goldsmith; Norman A. Yarrow, of Yarrows, Ltd.; R. Nield, manager of the Victoria Machinery Depot; L. F. Becker, of Johnson & Higgins, of Seattle; W. T. Isted, insurance adjuster, of Seattle; Mayor McBeath, of Vancouver, and a party of prominent business men from the mainland city; E. J. Palmer, manager of the Victoria Lumber & Mfg. Co.; Justice Martin, local Judge of Admiralty; Capt. J. W. Macpherson, Wreck Commissioner for British Columbia; C. H. Lugrin, president of the Victoria Board of Trade; R. T. Elliott; Mrs. R. T. Elliott; Col. Duff-Stuart, D.O.C.; Col. Tooley, J. O. Cameron, Lieut.-Commander Walter Wingate, commander of H.M.C.S. Grilse; Mrs. Wingate; Walter Adam, of E. B. Marvin & Co., etc.

Preparations for stepping the five masts with which the schooner is equipped, were begun immediately she had been brought alonside her builders' wharf, and progress since on the installation of yards, rigging, twin auxiliary engines, etc., point to the vessel being ready for service early in March. The principal dimensions are as follows:—Length over all, 260 ft.; length along keel, 225 ft.; beam, 44 ft.; depth of hold, 19 ft. The auxiliary power equipment consists of twin, oil fuel Bolinder type engines of 320 combined horsepower, these being reckoned to give a vessel speed under normal conditions of seven knots when under engine power alone. A crew of fifteen men will be carried.

Classed by Lloyds

The ships now under construction are being built according to plans passed by and under special survey of Lloyds, and when completed will be classed A1 for a period of twelve years. The cargo carrying capacity is estimated at 1,500,000 ft. of lumber and as this seems to be the most suitable parcel for the importers of lumber in Australia and the Cape, where the yardage accommodation in many cases is limited, the cargo capacity of these ships would indicate that they are well suited to the requirements of the trade in this respect.

The present shipbuilding activity in British Columbia had its direct root in the legislation passed by the late Conservative Government with a view to aiding the shipbuilding industry. A commission was appointed, with H. B. Thomson as superintendent, with power to loan amounts not to exceed a total of \$2,000,000, provision being made whereby the Commission could loan up to 55 per cent. of the value of the ships to be built under the terms of the Shipping Act, the ships to be under the Commission's control as regards loading charters, etc. To date, however, no loans have been applied for.

A bonus provision in the Act provides for the payment, up to twenty-five ships, of a bonus not to exceed an amount equal to \$5 per ton in respect of each ton of dead-weight cargo carrying capacity of the ship for a period, payable in ten annual instalments dating from the first year after the declaration of peace, "each of which instalments shall be so computed as to bring the net earnings of the ship, in respect whereof it is paid, up to 15 per cent. of the actual cost thereof, as certified by the Commission for the year in respect whereof payment is made."

All the ships contracted for have applied under this section. All ships operating under this section have to remain continuously in the British Columbia trade and are under the control of the Commission. It will readily be seen what a handsome inducement the Government placed at the door of any enterprising concern in the province in order to induce the development of this important industry.

Following in the steps of the Provincial Government move as above briefly detailed, the Dominion Government offered further encouragement to the industry by offering a rebate of duty on materials imported for use in the construction of ships in Canada to foreign order, and H. B. Thomson points out that if this is good business, it would be still better business to apply the same measure of encouragement for ships built in Canada for Canadian trade to carry Canada's products to the market of the world.

Decrease in Exports

In the matter of the seaborne export business of British Columbia, it is noticed that in the year 1895 the Province did 35 per cent. of the Pacific Coast lumber export business to Australia, and this has gradually declined until in the year 1912-13-14 it did not average 5 per cent., the States to the south having secured all the balance.

The export lumber business to India for a period of ten years shows that only on two occasions during that time did British Columbia secure as much as one-half of 1 per cent. of the business with our great Indian Empire, the States to the south on the Pacific seaboard securing the balance.

Discussing this phase of the situation, Mr. Thomson points out that the facts go to show that Canada will have to get some system of delivery of her products on the high seas, otherwise her export trade on the Pacific will not be developed as it should be.

"Taking a normal year," he remarked on the occasion of one of his addresses in support of an active shipbuilding programme, "we find the following conditions:—For the year 1913, the Commonwealth of Australia imported $10,500,000 of lumber. Of this amount the United States Shipped in 69 per cent., or approximately $7,000,000

Norway and Sweden	420,000
Russia	323,000
Canada	265,000

"In 1913 the fruit crop of Australia amounted to seventeen million dollars, consuming over ten million boxes, the box shooks being imported from the following places:

Sweden	54 per cent.
Germany	21 per cent.
Norway	15 per cent.

Making a total of 90 per cent., the balance of 10 per cent. coming almost entirely from the United States.

"In 1913 the lumber imports into New Zealand amounted to $2,500,000, of which United States got 67 per cent., while South Africa lumber imports for 1913 were over $6,000,000 and the same proportion maintained.

"The above figures are sufficient to show that ready and logical markets are open to us without taking into consideration the requirements of Europe and the Atlantic seaboard of the United States for our large dimension timbers, to say nothing of the finishing and smaller sized lumber which will be required, all of which trade will be greatly facilitated by the Panama Canal. It is a conservative estimate to state that the total output of 150 mills on the coastline of British Columbia have a yearly capacity of at least 700,000,000 feet of lumber, and abundant evidence is forthcoming that, with proper care, ventilation and salting, the Douglas fir of British Columbia will prove to be very well suited for the construction of wooden ships.

"Upon looking into the matter in the most casual way than, it must be apparent to most people that British Columbia is suffering in the export of lumber business from competition with the United States where by means of its control of the shipping by owners and brokers they virtually control the export business."

The ten wooden ships now under contract, two of which have been launched, a number of which are nearing completion, and more of which will be finished during the coming spring and summer are all being built for the Canada West Coast Navigation Co., of which concern H. W. Brown is managing director, and J. W. Norcross, James Carruthers, Roy J. Wolvin, Sir Trevor Dawson, M. J. Haney and James Whalen are directors.

Employees Smoker and Concert

In the evening following the launch of the Margaret Haney, the members of the shipbuilding staff of the Cameron Genoa Mills Shipbuilders, Ltd., and their friends, were treated to a smoker and concert in Eagle's Hall on Government Street, Victoria. A most enjoyable time was spent, the many toasts drunk being intermingled with short speeches by various members of the management and the staff of employees.

Manager W. S. Taylor, in his introductory remarks, complimented the employees on the manner in which they had rendered their services since the shipyard was opened. R. M. Wolvin, president of the Canada West Coast Navigation Co., H. W. Brown and J. H. Price also expressed their appreciation of the men's work. Messrs. E. W. Tribe and G. H. Swain, both well-known entertainers, were tendered a vote of thanks for the manner in which the evening's entertainment was carried out.

Among those specially commended by H. W. Brown, were Deane and Lloyd Johnson, superintendents on the work of constructing the vessels for the Cameron Genoa Mills Shipbuilders, Ltd., and Joe McKay, the latter holding the reputation of being the best plank liner on the Pacific Coast.

A feature of the evening was a three-round boxing bout between J. Moffatt, the boss painter and chief engineer W. James. The former tipped the scales at 135 pounds and the latter 140,, but, despite the latter's advantage in weight, it was anticipated that the boss painter would put it over the engineer. At the end of the third round, however, Referee Tribe declared the contest a draw, which means that the title for the championship of the shipyard will have to be decided at a time to be set in the near future.

NEUTRAL SHIPS AND ALLIED PORTS

THE *Official Gazette*, London, England, in its issue of Feby. 21, contains in order in Council dated February 16, for tightening the blockade of the countries with which Great Britain is at war, as a result of the German blockade memorandum of January 31, and similar enactments of other hostile countries.

"Whereas these enemy orders are in flagrant contradiction," the order reads, "of the rules of international law, the dictates of humanity and render it necessary for further measures to be adopted in order to maintain the efficiency of those previously taken to prevent commodities reaching or leaving enemy countries; His Majesty has ordered that the following directions shall be observed respecting all vessels which sail from their port of departure after the date of this order.

"First: A vessel which is encountered at sea on the way to or from port in any neutral country affording means of access to enemy territory without calling at a port in British or allied territory shall, until the contrary is established, be deemed to be carrying goods of enemy destination or enemy origin, and shall be brought in for examination and, if necessary, for adjudication before a prize court.

"Second: Any vessel carrying goods with enemy destination or of enemy origin shall be liable to capture and condemnation in respect of the carriage of such goods provided that in the case of any vessel which calls at an appointed British or allied port for examination of her cargo, no sentence of condemnation shall be pronounced except on carriage of goods of enemy origin or destination, and no such presumption as laid down in Article 1. shall arise.

"Third: Goods which are found on examination of any vessel to be goods of enemy origin or destination, shall be liable to condemnation."

The foregoing order apparently signifies a blockade of heretofore unknown stringency. U.S. commerce (if any), en route for Holland or Denmark, for instance, has to call at Halifax, or some other British or Allied port, or it will be seized and taken to one on the presumption that its failure to call is a confession of guilt. The same thing applies to Scandinavian ships in the Baltic. They must all call at Russian or British ports or they will be seized and taken there for examination.

MARINE ENGINEERING IN 1916

THE fact that so large a percentage of the output of marine engines and auxiliary machinery in 1916 was for purely war requirements makes it impossible to set out any statistical record dealing with the volume of work completed or to give any details of the work of particular firms, says the Liverpool Journal of Commerce. That new figures for output as measured by the basis of horse-power have been established, and that certain firms have eclipsed all old records is known to all those who have any inside knowledge of the position. At the same time, it is not merely the output of propelling and other machinery for warships which has occupied the attention of marine engineers, but serious consideration has also been given to problems associated with the growing need of making rapid additions to the mercantile marine.

Cargo Ship Energies

Quite apart from the construction of the hulls of the new merchant fleet, the production of the necessary machinery is likely to tax to the utmost the resources of those marine engineering establishments, the energies of which have been enlisted for the task. It is well known that the delivery of urgently needed new cargo steamers has in many instances been delayed owing to the impossibility of the output of marine engines keeping pace with the demand.

In spite of the competition of the steam turbine and the Diesel engine, the never types of reciprocating engine of

either the triple or quadruple expansion form have been shown to be the most suitable equipment for propelling machinery for the cargo steamer designed for a speed of about 10 knots. Details of these engines vary but slightly, and it is believed that if all the principal builders of reciprocating engines for cargo vessels can jointly agree on an absolutely standardised design, subject to annual revision, not only could a more efficient engine be produced but output would be expedited and manufacturing costs reduced. The idea underlying the proposal made is that the principle of subdivision of manufacture should be adopted, details being manufactured in bulk by selected firms and afterwards assembled. Quite apart from the advantages in connection with the needs of the war, such a manufacturing alliance should enable manufacturers of the reciprocating engine to challenge the newer forms of prime mover for marine service with added chances of success.

Geared Turbines

A feature of the past year, in addition to the general application of the ordinary form of direct driven turbine, has been the increased favour which the geared turbine has found with shipowners. The types of geared turbine which have attracted most attention are the Parsons and the Curtis. At the present time there are no fewer than 52 vessels being built to Lloyd's classification in which geared turbines will be fitted, and, of these 25 are being equipped with Parsons single-geared turbine and 27 with the Curtis double reduction geared turbine.

In connection with the Curtis turbine, it may be pointed out that in these engines the admission of the high-pressure steam does not take place round the whole of the circumference as in the usual types; another distinguishing feature being the ability to vary the area of opening. Moreover, owing to the comparatively few rows of blades which are employed, the drop of pressure past each row of blades is large, with a consequent high velocity of steam which again necessitates a very high speed of rotation. In some recent examples of Curtis installations, the turbine speed at full power has been over 3,500 r.p.m. The usual arrangement of the gearing is the coupling of the turbine shaft to a pinion with helical teeth which gear into two wheels mounted on separate shaft, each shaft transmitting one-half the power. Pinions on these shafts gear into a double steel wheel on the main shaft.

Turbo-Electric Systems.

Turbo-electric methods of propulsion are also making progress. The United States Government after satisfactory experience with the system in naval colliers has decided to equip some of the new battleships with turbo-electrical machinery. There are several means of applying this principle. Two vessels which are being built to Lloyd's classification are to be fitted with the Ljungstrom turbo-electro propelling plant, one a single-screw vessel of 1,500 s.h.p., and the other a twin-screw vessel of 5,400 s.h.p.

In this form of turbine no stationary blades are fitted, the steam passing along two sets of blades, which revolve at equal speed in opposite directions. Each half of the turbine is directly coupled to its own alternator, three-phase alternating current being produced at 50 alternations per second and a pressure of about 800. To ensure equal speed and equal power the alternators of each set are electrically locked. Two sets are fitted and the two alternators of each set work in parallel, supplying current to two 5-pair pole motors, these motors being connected to pinions, the teeth of which gear in the ordinary way with a large gear wheel secured to the screw shaft.

Reversing is effected by the electrical part of the plant, the steam turbines always running in the same direction. The gearing will enable the revolutions of the screw to be reduced from a speed of turbine of 3,600 r.p.m. to 76 revolutions per minute. Down to about 80 per cent. of full speed, reduction is effected by varying the steam supply to the turbine, regulation at lower speeds being obtained by the use of resistances in the circuit. Further experience of this system will be watched with considerable interest, the more particularly as this type of turbine is claimed to be adapted for the employment of the high superheat, the advantages of which are now generally recognized.

Marine Oil Engines.

In spite of certain failures in service, which are mainly the outcome of inexperience, the Diesel marine engine is making steady headway. The development of a new type of prime mover for ship propulsion was bound to be accompanied by difficulties, and that a few failures should have marked the course of the pioneer work is by no means surprising. It is clear, however, that the Diesel marine engine has come to stay There are now nearly fifty vessels built to Lloyd's classification which are fitted with engines of this type, and there are at present in course of construction to Lloyd's Survey over thirty sets of these engines. It may be pointed out that twelve of the Diesel engine ships now in commission are fitted with engines of the four-cycle type. The work in this field is mainly in the hands of Harland & Wolff and Burmeister & Wain.

A number of vessels have also been fitted with oil engines of other than the Diesel type, and over forty vessels in service or building have been or will be equipped with the Bolinder hot bulb engine.

The formation of an association of British marine oil engine manufacturers during the past year is a sound move. The objects with which the associaton has been formed are to bring about a general interchange of experience between manufacturers of the same or competing types; to take such steps as may be possible in the case of so young an industry to promote standardization, and to determine for the general benefit of all manufacturers the form which research work should take.

Superheating.

A considerable addition has been made during the year to the horsepower of marine engines which are designed for the use of superheated steam. The statistics which are now available making comparison between the performance of ships working on saturated and superheated steam have demonstrated the degree of economy which may be realized, both in reciprocating engines and marine turbines, and makers are now prepared to give guarantees which represent a considerable saving in fuel consumption. Practically all the geared turbine vessels are designed for superheat, and there is no doubt that the use of superheated steam in conjunction with oil fuel is likely to become a standard practice in this type of ship. The developments in main propelling machinery are naturally associated with changes in the design of auxiliaries, and these details are receiving the closest attention of marine engineers.

LATE NAVIGATION OPENING

THE outlook is for a late opening of navigation, as very heavy ice is reported all around, says a Cleveland, Ohio, correspondent. Owners are not giving offers that are made on grain much attention, as they figure they will have to get busy on their contracts at the start. Vessel men will take no chances on delay and will not charter for grain cargoes without a despatch guarantee. Indications are that Lake Superior traders will get a late start, as there is more ice in St. Mary's River and Whitefish Bay than there has been for years. Conditions are about the same in the lower rivers.

In the straits, ice is heavy and badly underdrawn, and car ferry steamers are having considerable trouble on Lake Michigan. Several boats were stuck at Milwaukee and other points during the month. Fields extend beyond human vision all along the south shore of Lake Erie, and ice is so heavy in Buffalo harbor that boats are shifted with much difficulty. A late opening will mean that some fleets will have about all they can do to take care of their contract business and will not have much free capacity, a let-up in despatch being looked for compared with the early part of last season.

British Government Approves of Kapok. — The British Government, through its Board of Trade, has approved of kapok and henceforth life preservers made with kapok instead of cork may be expected to find their way on board many British ships. The kapok tree grows in the tropics. The best quality at present comes from Java, but it is expected that the cultivation of the tree will soon yield the same results in the British West Indies and Central America. Kapok is capable of floating sixteen times its own weight of iron for over a week. Moreover, lifesaving jackets may be made with the best kapok for a fraction of the cost of a cork jacket.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S.S. "IROQUOIS" STRANDING

A FORMAL investigation was held in the City Hall, Toronto, Ont., on January 12, before Captain L. A. Demers, F.R.A.S., F.R.S.A, Dominion Wreck Commissioner, assisted by Captain James R Foote and Captain James McMaugh, acting as Nautical Assessors, into the causes which led to the stranding of the S.S. Iroquois, on or near Hare Island Shoal, River St. Lawrence, on November 27, 1916. Francis King appeared on behalf of the Canadian Lake Protective Association.

Master's Evidence

The master, Captain John Harold Hudson, stated that the Iroquois is a steel built, single screw vessel of 1,452 tons net and 2,359 tons gross, fitted with triple expansion engines, capable of a speed of 10 miles per hour, and carrying a crew of 18, including two officers with Inland Certificates; that his certificate did not permit him to navigate below Father Point; that the owners—the Canada Steamship Lines—engaged a sailing master at Quebec to navigate the Iroquois to Clarke City and return to Quebec. In order to satisfy customs requirements, the sailing master cleared the vessel at Quebec, becoming, in his point of view, virtually master of the ship, and having that idea, he, the master, relinquished his responsibilities.

It was his first voyage in that locality and he was therefore not conversant with local conditions. He was on deck when off Cape Dogs, which was passed at about a quarter of a mile off; but he did not notice the heading of the ship. The compass on the bridge was unreliable and bearings and courses were taken from the compass in the wheelhouse, which had a deviation of about 5 degrees W. Observations had been taken by range lights. He had noted and entered the course of the ship's head before going below, which was SW. by S. 7/8 S. The sailing master told him to go below, which he did, but not for the purpose of going to sleep.

Upon hearing or feeling some grinding, he went on the bridge. He did not notice that the ship was stopped. It was falling tide at the time and no steps were taken to see if the ship would float off. The watchman was sent to fetch the sailing master, following which he came on deck, after having been away from his post for some time. A boat was launched and manned, and he went over in it to Cape Salmon to summon assistance. During the afternoon the ship floated off, apparently with the help of the flood tide. Previous to reaching Cape Dogs the weather had been boisterous, with snow flurries, and strong westerly wind. From Cape Dogs, the weather was clear with light westerly winds.

Wheelsman's Evidence

Orila Beaudoin, the wheelsman, did not or could not, throw any light on the matter beyond stating that the lookout, who is called the watchman, kept vigil in the wheelhouse, sitting down at times; that the windows of the wheelhouse were all closed and frosty; that he steered by the compass. He had no course given to him by the sailing master; but was told to starboard half a point on more than one occasion, and afterwards to steady, with the ship heading SW. by S. 1/2 S. He did not remember much of the sailing master's actions beyond the fact that he left the wheelhouse frequently. On the whole, this witness proved unimportant; but he averred that he steered the vessel straight and that the ship ordinarily steered fairly well.

Sailing Master's Evidence

Theophile Roy Desjardins, the sailing master, who was unrepresented by counsel, deposed that he had acted as sailing master for the Canada Steamship Lines, and its predecessors, for 12 years, without accident; that he cleared the Iroquois at Quebec and assumed he was the master. From Red Island to Cape Dogs strong winds and snow flurries were experienced. He shaped a course for Cape Dogs and listened for the fog horn, and when the weather cleared he was about a quarter of a mile distant from Cape Dogs, with Salmon Point on his port bow. He gave the order to starboard and brought Cape Salmon Light half a point on the starboard bow, giving the course SW. by S. This statement was changed several times during the examination, finally resolving itself in the fact that he had given orders to starboard half a point and that the ship was heading the above-mentioned course.

He had been up a few hours, and, feeling sleepy, retired to his room, took a magazine, sat down and fell asleep. He left the master in the wheelhouse when he went below. He stated he was never called, but came on deck and found the ship was aground, heading SW. by S., and could not understand how she came there. He was positive the ship was heading SW. by W. when he went to his room. No steps were taken to float the vessel; but soundings were made within and around the ship, and it was found she was not making water, and at low tide it was seen that she was resting amongst large boulders. He admitted he made a mistake by going to sleep. Failing to answer clearly questions put to him by counsel, he was again reminded that he could be examined in his own language if he wished, and was in fact questioned on certain points in that language. This concluded the evidence.

Finding

Having carefully weighed and considered the evidence adduced, the court finds that the statements made by Captain Hudson, of the Iroquois, were straightforward, but indicative of a lack of ambition to acquire further knowledge of the work he was likely to be called upon to perform in the future, which is surprising in a young member of the profession; his conduct, therefore, borders on indifference. His first officer was sick in bed, while the second officer's watch began at 4 a.m. From midnight until 4 a.m., or rather until the time of stranding, the bridge was left in the sole charge of the sailing master, and the ship's navigation was performed from within the wheelhouse with the windows closed. No lookout was stationed as required by law. Yet in view of all these conditions he chose to withdraw to his room.

Owing to the conditions existing, and in view of the fact that no special instructions had been given him by his employers, which caused him to be impressed with the idea that from the time the sailing master took charge and until the voyage from Quebec to Clarke City and return was completed, he had no responsibility, the court views his absence from his post with leniency and only reprimands him severely for his seeming indifference to the interests of his owners. On this point an opinion is expressed that it would be well whenever a sailing master is engaged, that the master should be instructed to the effect that he is still the responsible officer. In previous cases this court has enjoined and recommended that masters should show more loyalty to their owners by acquiring all the knowledge possible of conditions existing in waters strange to them, and which they may be requested to frequent in future owing to the constant alterations of trade and development of commerce.

With respect to Desjardins, the sailing master, his evidence was a tissue of contradictory statements, and the court has a doubt whether Desjardins clearly understood the import of questions put to him. The privilege to be examined in his own language, which was extended to him, was not accepted, he choosing to be examined in the English language, which he said was just the same to him. He, however, acknowledged that he should not have left the bridge or the navigation of the ship without first assuring himself that he was relieved temporarily by a competent officer. He showed a lack of proper sense of responsibility. His navigation was indif-

ferently done. Instead of giving a direct course to be steered from Cape Dogs to Cape Salmon, his order was to starboard.

He states that he felt sleepy, and this condition may account for the fact that he starboarded and in doing so did not perceive the revolving light of Cape Salmon; but brought the Kamouraska Light (which is revolving every 30 seconds), on the starboard bow, through which the ship stranded. Her heading when aground showed conclusively that an error was made in the light, and this error could only occur through indifferent navigation. Had the compass been consulted, it would have revealed the mistake immediately. The conduct of the sailing master cannot be condoned, for if, as he stated, he considered himself legally the master of the vessel, then there is no justification for his carelessness. In view of the circumstances, the court suspended his certificate for a period of nine months from January 20 to October 20, 1917.

PROPELLING MACHINERY FOR SHIPS—I.*

By W. J. Drummond.

THE questions dealt with in this paper are only such as involve general consideration, and no attempt is made to go into details. When deciding on the type of machinery to be adopted in any ship, the most important general features to be considered are:—Reliability, economy of fuel, ease of manoeuvring, and weight in relation to the power developed, the latter being particularly important in the case of warships.

Too much stress cannot be laid on reliability, for the engines of a ship may have to run, and often do, for forty to fifty days without a stop, and in many cases the safety of the ship depends entirely on the ability of the engines to do the work required of them in a heavy sea and under circumstances never met with in land practice. In addition to being absolutely reliable, marine engines must be capable of being rapidly and easily reversed, and it is essential for warship work that the power developed can be varied from one-eighth full power to anything up to full power, or vice versa, at very short notice. Mercantile and warship machinery are so essentially different in type that it is difficult in most cases to make any fair comparison between the two. Weight, for example, plays a much more important part in the naval than in the merchant service, and whereas a merchant ship has its designed speed at which she ordinarily steams, a warship seldom steams at full speed, and consequently her machinery has to be reasonably efficient at cruising as well as at high speeds. It is a further advantage in a warship if both engines and boilers may be considerably overloaded for brief periods, for extra speed for a short time may be very valuable, even if obtained at a considerable sacrifice of efficiency. In dealing with marine as compared with land installations, it must be remembered that there is no spare machine to put in circuit in case of a breakdown, and that the powers, in turbine practice at any rate, are very much larger, running in a recent battle cruiser to 120,000 s.h.p.

By far the commonest type of machinery afloat is the 3-crank triple-expansion condensing engine, supplied with steam by cylindrical boilers. There are numerous variations of this arrangement, all made with the object of getting more power out of a given weight of coal, and thereby increasing the steaming radius for a given coal supply, or allowing more space for cargo and passengers, or possibly reducing the size of the ship for the same service. The marine triple-expansion engine as it exists to-day is the result of years of experience, and is a highly-efficient piece of machinery. As representing the highest achievement in this type of machinery, the following comparison, at a speed of 19 knots, between two battleships built for the U. S. navy is interesting.

The Texas, 26,000 tons; two 4-cylinder, triple-expansion engines; fourteen Babcock & Willcox boilers; boiler-pressure, 285 lbs. per square inch; i.h.p. at 19 knots, 19,600; revolutions, 110; coal per i.h.p. per hour, 1.47 lbs.; water per i.h.p. per hour, 13.87 lbs.; knots per ton of coal at 19 knots, 1.49.

The Florida, 21,000 tons; Parsons turbines on four shafts; twelve Babcock & Wilcox boilers; boiler-pressure, 200 lbs. per square inch; s.h.p. at 19 knots, 20,200; revolutions, 290; coal per s.h.p. per hour, 1.72 lbs.; water per s.h.p. per hour, 15.23 lbs.; knots per ton of coal at 19 knots, 1.24.

It is worth noting that the reciprocating-engined ship is the later and larger vessel, and at 19 knots can steam six miles to every five of the turbine ship for the same expenditure of coal. The full speed of the Texas is 21 knots, and of the Florida 22 knots. Of course, these figures represent the high-water mark of warship practice in reciprocating engines, and must not be taken as representing the results obtained with cargo or intermediate passenger vessels, but they afford a good example of what can be done.

Reciprocating Engine and Turbine Combination

An arrangement which is the logical outcome of a desire to use the steam down to as low a pressure as possible deserves notice. It consists of two triple-expansion engines which take steam direct from the boilers and exhaust into a low-pressure turbine. The usual arrangement is to have three shafts, the reciprocating engines driving the wing shafts, and the turbine the centre one. In many cases the turbine receives steam at less than atmospheric pressure and develops from one-quarter to one-third of the total power. In addition to greater economy than either an all-turbine or an all-reciprocating engined vessel, this arrangement has the advantage over an all-turbine vessel of the astern power being a large percentage of the ahead, and of the large slow-running propellers of the reciprocating engines being available for stopping the vessel. When the vessel is under way astern, the turbine revolves in vacuo, the steam from the reciprocating engines being passed straight to the condensers. This arrangement has been used successfully on many of the largest steamers afloat, the six largest vessels built in 1914 being so fitted.

Geared Turbines

In England, so far as large, high-speed vessels of both the naval and mercantile marine are concerned, the turbine coupled direct to the propeller more than holds its own in competition with the reciprocating engine, and efforts are principally devoted to attempts at enabling turbines to be used for cargo and intermediate passenger vessels. To do this successfully the propeller must run at 80 to 200 revolutions, while for maximum efficiency the turbine runs at 2,000 to 3,000 revolutions. Chief among the methods adopted to affect this reduction is the mechanical gearing associated with the name of Parsons in England, and Westinghouse in America.

The Westinghouse arrangement has the disadvantage of being more complicated; to obtain more perfect alignment, the gearing is carried by a floating frame instead of being supported by rigid bearings, as in the Parsons system. In both cases the teeth are helical, closely pitched, and cut by special machines so as to ensure absolute uniformity and to reduce the noise. Although originally introduced with the idea of making turbines applicable to slow-speed vessels, mechanical gearing has shown its utility in all types of vessels. As typical of the geared turbine machinery for a large intermediate passenger vessel, the following particulars of the Cunard S.S. Transylvania may be quoted: 9,500 s.h.p. on two shafts; each shaft is driven by two turbines, a high and a low pressure, operating through reduction gearing of 12½ to 1; revolutions of propellers at full speed of 15 knots, 130; steam consumption 11½ lbs. per s.h.p. per hour. An astern turbine is incorporated in the low-pressure turbine casing; the diameter of the gear wheel on the propeller shaft is 10 feet, and the breadth 5 feet.

In several cases direct comparison has been made between ships fitted with reciprocating engines and geared turbines. In England the most noteworthy comparison was that between the single-screw cargo steamers Cairncross and Cairngowan, the former, fitted with geared turbines, and the latter with a triple-expansion engine, the vessels being in other respects identical. The test was very exact; both vessels were docked, coated with the same composition, and supplied with coal from the same colliery. They were then run at the same speed on parallel courses for thirty-six hours, and careful measurement was made of coal and water consumption, etc. The net result of the trial may be

*Read before the Institution of Mechanical Engineers—Graduates' Association.

expressed by the fact that the Cairncross burnt 27.8 tons of coal per twenty-four hours, against the Cairngowan's 32.8 tons.

As regards geared turbines in warships, practically no data have been published; several British destroyers and destroyer leaders of the Aurora type have been so driven, but for large vessels the 4-shaft direct-drive with Parsons turbines is still the only type of machinery used in England, though the United States are fitting geared turbines in one of their battleships.

One of the objectionable features of the early geared turbines was the noise. By paying great attention to the machining of the teeth this has been largely reduced, but there is still a good deal of vibration and noise in the engine-room, a matter of considerable importance in passenger vessels. Due to efficient means of lubrication, the wear on the teeth is negligible; on some geared-turbine ships trouble has been experienced with gasification of the lubricating oil, and in consequence smoking is prohibited in the engine-room. The efficiency of the gearing is very high; it averages 98½ per cent., and goes as high as 99 per cent.

RECENT PROGRESS IN DREDGING MACHINERY*

By William Brown, M.Inst.C.E.

THIS paper deals with bucket dredgers, suction dredgers of the "cutter," "drag," and "moored" types, and dipper dredges. Each of these types, within its limits, is recognized as being best suited for particular classes and conditions of dredging, and the vessels described in the paper have not been selected because of any phenomenal dredging done by them, but because special attention has been devoted to their design to meet the several conditions of their intended use.

With regard to the question of dredging costs, no fair comparisons can be made unless due regard is had to all the items—labor, coal, oil and stores—and to the physical conditions met with. Comparisons are only of value when the conditions are fully explained, when all corresponding details are included in the charges, and when the methods of accounting at the various ports are reduced to common terms.

Bucket Dredges

The bucket hopper dredge Silurus is taken to represent the most modern dredge of the bucket type, and particulars are given of the work done by the dredges Corozal, Kuphus and Octopus. The Silurus is a twin-screw bucket hopper dredge built of steel to Lloyd's requirements, for the port of Bombay.

	Feet.
Length between perpendiculars	260
Breadth, moulded	46
Depth, moulded	20

The hopper has a capacity of 1,500 tons. The steam-generating plant consists of two marine cylindrical multitubular boilers, and there are two main engines of compound surface-condensing type for propelling the vessel or for driving the dredging gear as required. The gearing between the main engines and the upper tumbler is so arranged that, with a constant piston speed of the main engines, two different speeds of buckets can be obtained. Two sizes of buckets are provided, one set of 42 cub. ft. capacity for excavation in soft material, and a smaller set each of 22 cub. ft. capacity.

Clay-cutting Suction Reclamation Dredges

These dredges give satisfactory results in all classes of clay, as well as in free material, and on occasion cutter dredges have been employed on stiff blue clay and on hard chalk, which have been found a severe test of the capabilities of powerful bucket dredges. The cost of repairs and renewals in cutter dredges when working in hard material is less than with bucket dredges, owing to their wearing parts being much fewer, the only parts of importance subject to hard wear being the cutter blades and liner plates of the pump, as against the buckets, pins and bushes, tumblers, and ladder-rollers of a bucket dredge.

The clay-cutting suction dredges Jinga and Kalu, which are described, were ordered by the Bombay Port Trust for carrying out a very large reclamation scheme undertaken by them. These vessels were designed to be capable of dredging 2,000 cub. yards of soft clay and mud per hour from a depth of 30 ft., and discharging the material so dredged to a distance of 4,500 lineal ft. on shore. The dredging depth was subsequently increased to 40 ft. Their dimensions are:—

	Feet.
Length on main deck	205
Breadth, moulded	42
Depth	13

The dredging pump is driven by a set of triple-expansion inverted direct-acting surface-condensing engines. The boilers are four in number, of the cylindrical multitubular type and provided with Howden forced draught. The cutter is of rotary pattern. In the Twante Canal, connecting Twantewa with Rangoon, suction cutter dredges were employed to cut the clay that formed the bank and bed of the canal and pump it through a floating pipe-line to alongside of wherever it was desirable to deposit it upon the bank, and then raise and discharge it by means of a floating terminal pontoon with a raised pipe overhanging the bank.

Three suction cutter dredges, each with 1,000 ft. of floating pipe-line and a

*Abstract of a paper read before the Institution of Civil Engineers, January 9, 1917.

TYPICAL CANADIAN SHIP REPAIR AND FLOATING DRY DOCK PLANT WITH VESSEL ABOARD.

The Diesel Engine

A type of engine which may make the use of oil fuel more general in the merchant service is the Diesel. A limited number of Diesel engines have been fitted on board ship, but they are all of comparatively low power. In addition to increasing the power of the individual engines, greater reliability, improved methods of reversing and of varying the speed of rotation will have to be provided before the number of Diesel engines afloat can be expected to increase to any extent, except for such specialized work as submarines, where electrical power is available for going astern, and for starting up the Diesel engines. In one or two cases, Diesel engines have been fitted as the cruising machinery on oil-fired turbine destroyers, but it will be some time before the Diesel engine can hope to oust steam in such vessels, for the boilers, turbines and all auxiliaries only weigh about 40 lb. per s.h.p., and the oil consumption at full power, about 20,000 s.h.p., is 0.9 lbs. per s.h.p. per hour.

terminal pontoon with 80 ft. overhang, were ordered by the Indian Government. The Oswald and Campbell, the two smaller boats, both have 24 in. diameter suction and discharge pipes, and the Lees has a suction pipe 30 in. in diameter and a discharge pipe 27 in. in diameter.

Moored Suction Dredges

At Durban, where suction dredges of the moored type have been employed with excellent results, the depth of water at the entrance in 1884 was 7 ft. 2 in., which had become 36 ft. 5 in. in 1914, mainly as a result of dredging. Up to the end of the year 1914 the total volume of solids removed at Durban amounted to 81,737,292 tons. The chief difficulty of dredging on the bar at Durban is that the work has to be carried out in the open sea and subject to heavy weather. To meet such conditions, the suction pipes of the Durban dredges are in two parts, joined together by flexible armored piping spanned by universal joints. The upper end of the suction pipe is carried on a trunnion bearing near the deck, and the nozzle end is controlled by hydraulic hoist gear designed to maintain the two lengths of pipe relative to each other in the same line of axis when working at any depth. The hoisting gear is so arranged that when the length of pipe below the joint deviates from its axis with the upper length, the hoisting gear automatically raises the lower length, thus allowing the lower end to clear the obstruction which caused the deviation.

At Lagos, a pump dredging plant is used in connection with deepening the bar at the entrance to the harbor, which has hitherto been subject to considerable fluctuations. The dredges employed particularly for this part of the work at Lagos are the pump hopper dredges Egerton and Sandgrouse. In their main features they are much alike, the Sandgrouse having a hopper capacity of 1,800 tons, while the Egerton's hopper capacity is 1,200 tons. The dimensions of the Sandgrouse are:

Length	291 ft. 0 in.
Breadth	45 ft. 0 in.
Depth	18 ft. 9 in.

She is fitted with two sets of triple-expansion surface-condensing engines driving twin screws, and one set of triple-expansion engines directly connected to the dredging pump. Steam is supplied by three marine cylindrical multitubular boilers. The suction-pipe arrangement permits of entire flexibility in any direction.

The remaining dredging plant at Lagos has been principally provided with a view to the reclamation of certain swamps. The reclamation dredge is specially arranged for pumping from barges alongside by means of two independent dredging pumps so arranged that they may work either singly or in series, depending upon the distance the material is to be discharged.

The suction cutter hopper dredge for Lagos, now under construction, is fitted with one set of triple-expansion surface-condensing engines arranged to drive the dredging pump or the propeller, as may be required. The outboard suction pipe is fitted with a special drag nozzle for use when dealing with compact sand, while a spiral rotary cutter is provided for dealing with clay and harder material. A special feature in this vessel is that four independent automatic mooring machines, four capstans, and one steam windlass are provided for mooring purposes.

TYPICAL CANADIAN FLOATING DRY DOCK WITH VESSEL ABOARD.

Drag Suction Dredges

The M.O.P. 210.C and M.O.P. 211.C are selected to illustrate the drag suction or moorless type of dredge. They were specially designed and constructed to meet the conditions prevailing at Buenos Ayres, and the character of the material there met with. These vessels have a hopper capacity of 1,650 cub. m., and are each fitted with four sets of triple-expansion engines. The engines are arranged in pairs, so that all four sets are available for driving the dredging pump or the propellers separately, or two sets may drive the dredging pumps and two sets drive the propellers at the same time, as may be required. Steam is supplied by four cylindrical multitubular boilers. When commencing work the vessel is steamed slowly ahead on the desired line of excavation, and the drag nozzle is lowered into the material until the inlet opening of the nozzle is completely sealed by the clay to be raised, so that the load on the hopper is made with the minimum amount of added water.

The drag suction dredges Cormorant at Rangoon, and Canterbury at Lyttelton are of the same type as those employed at Buenos Ayres. The Cormorant is 204 ft. long, 38 ft. moulded breadth, and 17 ft. 6 in. deep; hopper capacity 27,000 cub. ft., mean draught 14 ft. 3 in., and speed per hour on measured mile, $9\frac{1}{2}$ knots. She is fitted with patent steering jets, so that the vessel can be steered entirely independent of the rudder. The dimensions of the Cormorant and the Canterbury are alike. The only difference of vital importance is the arrangement of the propelling and pumping machinery. In the Cormorant, one pump was fitted driven by independent engines, while two sets of engines were fitted for propelling, each driving one twin screw direct. In the Canterbury the machinery arrangements are similar in all respects to the arrngements already described for dredges M.O.P. 210.C and M.O.P 211.C.

Dipper Dredges

To illustrate this type of dredge, the modern 15-cubic yard dipper dredges Gamboa and Paraiso, employed on the Panama Canal, have been selected. The ability of these dredges to dig into a bank of shale, sandstone, lignite, or any of the softer rocks, to dispose expeditiously of a rock too large to pass through the dipper, to dig to 50 ft. depth and load into scows of almost any size, makes them very valuable tools for work of this class. They are capable of dredging 7,000 to 10,000 cub. yards of rock per day of 24 hours, depending on the degree of hardness of the material. The material handled by them is loaded into bottom-door steel dump scows. The principal features of the Gamboa and Paraiso are as follows:—

Each dredge has two dippers respectively of 15 and 10 cub. yards capacity. The dipper handle is 72 ft. long. The main hoisting engines are of the twin tandem compound type. The winding drum is graduated so as to give a low speed when digging. The swinging engine is of the double-cylinder high-pressure type, with steam-operated link reversing gear. The dredge is fitted with three spuds. The forward spuds are placed far enough back to allow a swing of 180 degrees for the boom. The third spud is placed centrally at the stern.

Pressure Oil Film Lubrication--Michell Journal Bearings*

By H. T. Newbigin, A.M.I.C.E.

To reduce friction to the absolute minimum, between two rubbing surfaces, it is necessary that some medium, such as grease or oil be maintained in film form, so as to prevent actual contact of metal with metal. This article embodies a resumé of bearing practice generally, while discussing at considerable length the Michell invention particularly.

THE primitive form of journal bearing is merely a hole bored in the frame of a machine in which a shaft revolves, and the primitive thrust bearing is only a collar or shoulder on a shaft to prevent it moving endways. These fulfil their function satisfactorily for many purposes, but as the rubbing speed increases, either due to an increase in the shaft diameter or an increase in the speed of its rotation, or both, it becomes necessary to devote more attention to the design of these machine parts, apart altogether from the effect of a reduction in friction on the efficiency of the machine as a whole.

Without lubrication a bearing will not run without excessive wear, and without artificial cooling no bearing with oil lubrication will run continuously if the temperature rises above 150 deg. F., because at about this temperature most oils begin to carbonize. The efficiency of a bearing must, therefore, be such that the temperature due to the heat generated by its friction, minus that dissipated by radiation and conduction, does not exceed this figure. In order to reduce the friction between two rubbing surfaces it is necessary to put something between them, and bearings may be classified into those in which this is a hard material such as steel balls or rollers, or a viscous substance like oil or grease.

Ball and Roller Bearings

The first class does not consist merely in introducing balls or rollers between the relatively moving surfaces in the primitive forms of journal and thrust bearings, they are highly specialized machine parts designed to utilize to the greatest advantage the rolling action of balls or rollers in reducing friction, and their design is evolved from a study of this action. On the other hand (except in the cases to which reference will be made later), the second class consists merely in applying a lubricant to the primitive forms, or to some slight modification thereof. They are not designed to utilize the action of the lubricant on any principle, the lubricant is merely added to the primitive forms because it has been found to make them work better. Ball and roller bearings have attained to a remarkable degree of perfection, and they are admirably suited for bearings in which the loads to be carried are comparatively light, or in which the motion is intermittent, but they are not suited to carry heavy continuous loads, especially at high speeds.

In ball bearings the steel balls make point contact with hardened steel races, and the balls tend to flatten at the point of contact. Under excessive continuous loads this slight deformation of the balls causes their outer surface to shell off, the chips get under the other balls, and ultimately destroy the construction of the bearing. The life of the balls is limited, frequent renewals are necessary, and to effect these renewals it is essential to dismantle the bearing.

In roller bearings the rollers make (or are supposed to make) line contact with the housing and with the shaft. Although they are able to carry heavy loads, it is very difficult to maintain correct alignment, and any slewing of the rollers sets up a heavy end thrust against the cage in which they work. Furthermore, as the rollers bear directly on the shaft, the constant rolling action tends to laminate the surface and so wear it away. In roller thrust bearings it is necessary to make the rollers conical, and as they therefore have a heavy radial thrust this type of bearing is not much used.

The great advantage of both ball and roller bearings is their low starting friction; for this reason they are especially suitable for intermittently moving machinery, but in continuously running machinery, where a low starting friction is of less importance than a low running one, it is obviously a great advantage to have the rubbing surfaces separated by something more easily replaceable than either balls or rollers, especially if it is something that can be continuously replaced without stopping the machine, and the more so if it is also capable of being used in high-speed bearings as a medium for carrying away the heat generated by friction from the actual surface of its origin.

It is with the second class of bearings—those in which the surfaces are separated by a fluid such as oil in the case of high-speed and grease in the case of slow-speed bearings—that this paper is more immediately concerned. The use of a lubricant for the purpose of reducing friction is very old, but the study of its action, and more especially the manufacture of bearings designed to utilize this action to the best advantage, is quite modern.

Lubricant Action

The action of a lubricant is twofold: it first of all alters the nature of the rubbing surfaces, thereby reducing friction (and this is the commonly accepted justification for its use), but under favorable conditions it goes much further than this and automatically generates a high-pressure oil film between the surfaces, entirely eliminating metallic contact and thereby enormously reducing the friction. This is what is now called "pressure oil film lubrication." It occurs to a limited extent in most journal bearings, but does not occur in ordinary collar-thrust bearings.

The phenomenon of pressure oil film lubrication was first noticed by the late Beauchamp Tower during the course of a series of tests he made in conjunction with the Institute of Mechanical Engineers in 1883 and 1885. He found, while experimenting with a journal bearing, that under certain conditions the rotation of the shaft was capable of dragging the oil adhering to it in between the surfaces to such an extent as to force the surfaces apart with a high-pressure oil film, and that the highest pressure in this oil film was about twice the average pressure. He also found that the highest pressure was on the longitudinal centre line of the brass and a little forward of the sectional centre line in the direction of rotation, and that from this point the pressure fell to zero around the edges of the brass. A bearing under these conditions runs with very much less friction than under any other, and will carry a much higher load.

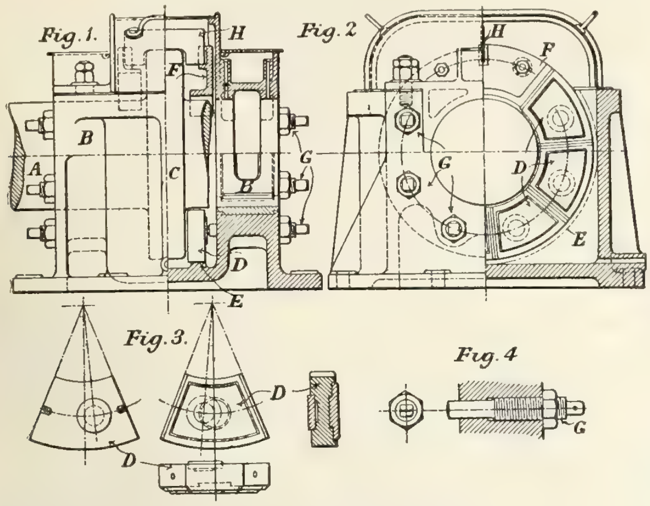
Following on Tower's experiments, the late Professor Osborne Reynolds, F.R.S., in a paper read before the Royal Society in 1886 on "The Theory of Lubrication," showed that the friction under the circumstances was merely that due to the viscous flow of the oil, and he showed how, by calculation based on the theory of viscous flow, a pressure curve may be obtained which closely approximates to that obtained experimentally by Tower.

In his theory Reynolds made the assumption that the length of the bearing, i.e., the dimension at right angles to the direction of motion, was infinite, and as this is never the case in practice, his theory was of little practical value and it did not lead to any alteration in the construction of bearings. From the practical point of view the most important things that he showed were:—

Firstly—That in order to obtain a pressure oil film between lubricated sur-

*From a paper read recently before the British Association.

faces the surfaces must have a slight inclination to each other, with the opening at which the oil enters greater than that at which it leaves. Or, in other words, that the oil film must be wedge-shaped.



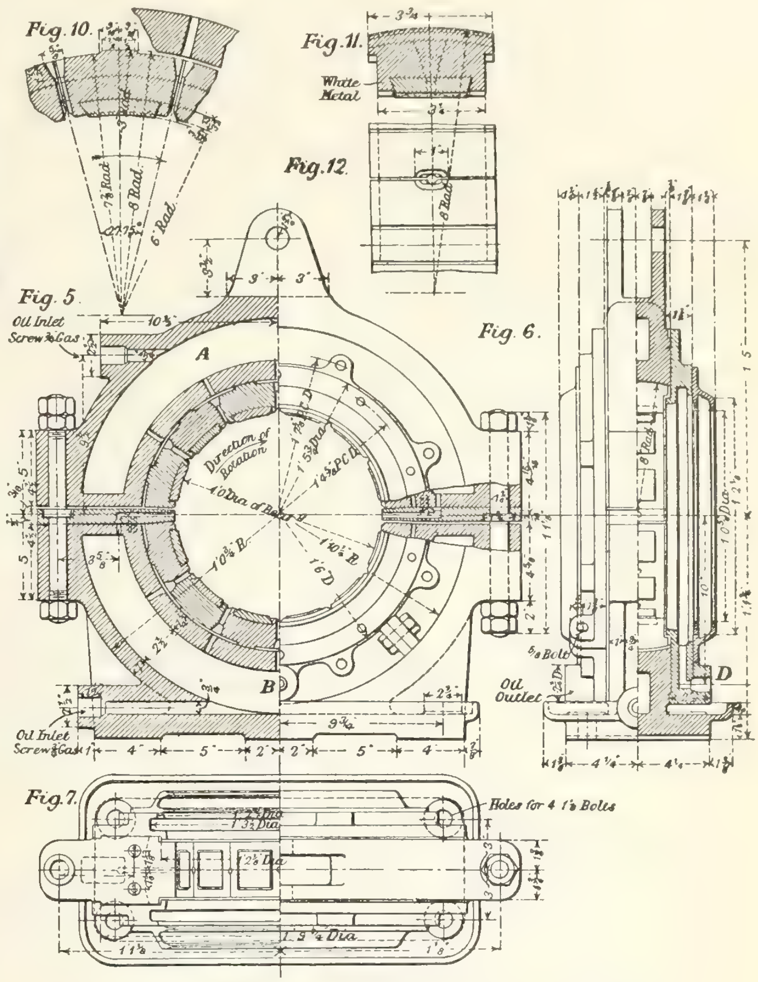
MICHELL THRUST BEARING DETAIL.

Secondly—That in the case of a journal bearing the wedge form of the oil film occurs naturally, due to a slight shifting of the centre of the shaft in relation to the centre of the brass.

Thirdly—That such a wedge-shaped oil film cannot occur in a collar-thrust bearing; hence their inefficiency and low carrying capacity.

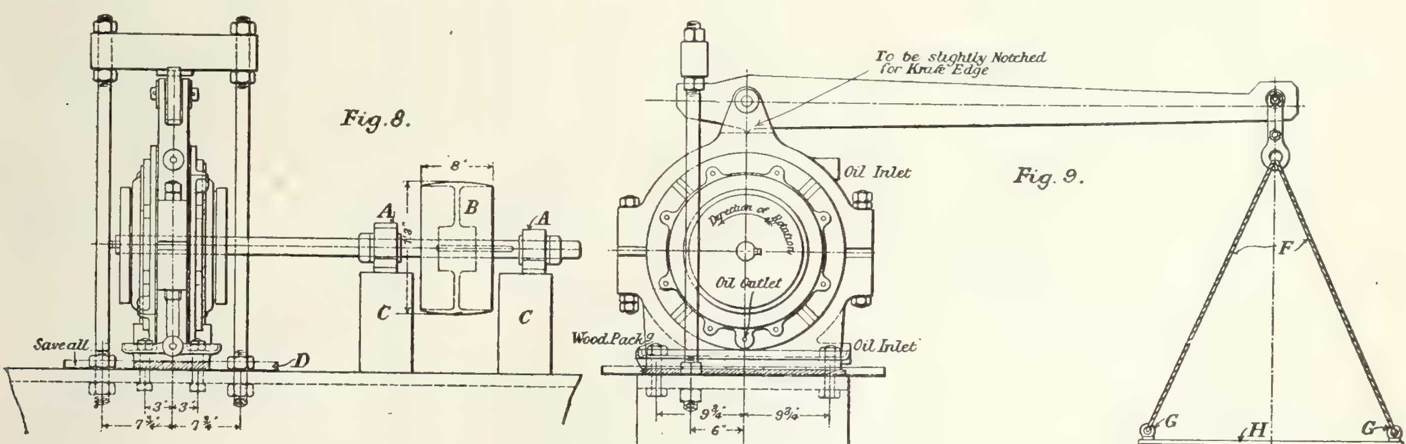
It was left to an Australian engineer and mathematician, A. G. M. Michell, of Melbourne, not only to complete Reynolds's theory, but also to show how its teaching can be applied in practice, to the vast improvement of both thrust and journal bearings.

In a paper published in "Zeitschrift für Mathematik und Physik" (unfortunately a German publication) in 1905, on "The Lubrication of Plane Surfaces," he gave the complete mathematical solution of Reynolds's theory as applied to plane rectangular surfaces. On the assumption that the thickness of the oil film at the entering edge is twice as great as at the leaving edge, he showed how lines of equal pressure within the film can be plotted and how the centre of resultant pressure can be determined for plane rectangular surfaces of varying proportional cross dimensions. He also demonstrated practically that a rectangular block pivoted at its point of resultant pressure will automatically assume an angle to an opposing lubricated surface, depending on the speed of rubbing, viscosity of the oil and pressure. On this principle he founded his now well-known thrust bearing.



DETAIL OF MICHELL JOURNAL BEARING AS TESTED.

The result of Mr. Michell's work has been to enable lubricated thrust and journal bearings to be designed with the principles of oil film lubrication as a basis, in the same way as ball and roller bearings are designed with the ball or roller as a unit, and as distinguished from the mere application of oil to the primitive forms of these bearings. The essential feature of the Michell bearings is the sub-division of the stationary sur-



TESTING EQUIPMENT OF MICHELL JOURNAL BEARING.

face into a number of blocks or pads, each pivoted at its back, and so free to assume a slight angle with its contacting surface. Bearings designed on this principle differ radically from the primitive forms of journal and thrust bearings, but the results obtained in practice have fully justified the change.

Thrust Bearing Comparisons

Taking the case of the thrust bearing first, the Michell thrust bearing differs from the older type in having only one collar, the multiplicity of collars in the older type having been necessitated by the low carrying capacity of parallel rubbing surfaces, as distinguished from the high carrying capacity of those in which the fixed surface is sub-divided and made free to assume the angle to the opposing collar necessary for the formation of oil pressure within the film.

The importance of efficiency in machinery is not merely a question of economy of power or fuel, it also controls the practicability of a design, and the design of bearings is an example of this. For example, in the design of a large multicollar thrust bearing (which is merely an elaboration of the primitive form) the problem the designer has to solve is governed by the efficiency of this form. He has given a shaft of a certain diameter, revolving at a certain speed, and which has to withstand a certain thrust. The resistance to turning will be about 0.03 of that thrust, and the greatest load that the bearing surfaces will carry with safety is about 50 lb. per square inch.

Low Coefficient of Friction Essential

In order to bring the pressure down to this figure, he may either use a few collars of large diameter or a number of collars of small diameter. If he does the former, he increases the radius at which the friction acts, and so the power absorbed and the heat generated, and if he does the latter it becomes increasingly difficult to maintain an equal distribution of the load among the collars, especially under the variations of expansion due to the heat generated when the bearing is at work. Furthermore, whatever compromise he makes, there comes a point beyond which the size, load and speed cannot be increased because, owing to the high coefficient of friction, the heat is generated more quickly than it can be dissipated by radiation and conduction, even with the aid of water cooling.

This point was reached in the case of the thrust bearings in geared turbine-driven vessels, and partly because the bearings were found to be less able to withstand thrust under the uniform turning movement given by this type of engine than under the varying turning movement given by reciprocating engines. It therefore became necessary to find a form of thrust bearing in which the coefficient of friction is lower than that in the primitive type.

Michell Thrust Bearing Details

The Michell thrust bearing, which goes to the root of the matter and is designed from the point of view of the action of the lubricant in automatically generating a pressure oil film between the surfaces, has formed a complete solution of the difficulty. It has a coefficient of friction of about 0.0015 as against 0.03, and carries 200-300 lb. per square inch with a much greater factor of safety than the primitive form has at 50 lb.

The sub-division of the fixed surfaces into a number of segmental tipping blocks or pads is the essential feature of all thrust bearings made on this principle, but there are many variations in the design of the housing and method of carrying the tipping blocks, depending on the particular use to which the bearing is to be put.

Figs. 1 and 2 show sectional side and end views of one form in which marine thrust blocks are made. The shaft A is supported in two journal bearings B, one on each side of a single collar C, which bears against two series of segmental pivoted blocks D, arranged in the form of two inverted horse-shoes, the one for "ahead" and the other for "astern" thrust. The blocks D—each of which is pivoted, somewhat behind its centre, on the ends of the screws G—rest on two ledges E, concentric with the shaft. They are prevented from rotating with the shaft by means of the stops F, by removing which they may be taken out without disturbing the adjustment of the screws G or lifting the shaft. Figs. 3 and 4 show a detail of one of the blocks D, and of its screw G.

The body of the housing forms an oil well in which the collar revolves, and a scraper H is provided to scrape off the oil brought up by the rotating collar for the purpose of lubricating the upper blocks. This type is self-contained as regards lubrication, and in the case of large sizes, or those running at a high speed, the body of the bearing is water-jacketed. The friction is about one-twenty-fifth of that in the multicollar type.

Steam Turbine Thrust Bearings

In the case of the thrust bearings in steam turbines the type adopted is somewhat different. The blocks are symmetrically disposed around the faces of the collar, and each series is mounted on a ring partly spherical on one face, the convex surfaces of which are outward and rest on correspondingly spherical seats for the purpose of automatically distributing the load among the blocks. The blocks are mounted on the faces of the rings next the two sides of the collar against which they pivot, either along radial lines or on rounded pins.

This type is entirely enclosed, and is supplied with an oil circulation by means of an independent pump. The oil passes through an oil cooler on its course, thereby removing the heat generated by friction from the actual surface of its origin. The mean rubbing speed sometimes exceeds 100 ft. per second. Slow speed bearings are made on the same principle, with grease lubrication.

Upwards of 800 Michell thrust bearings are now running in Great Britain alone, in sizes varying from 1 to 15 in. diameter of shaft, and larger sizes are in the course of construction. The use of them is rapidly becoming the standard practice in steam turbine work. The same principle is now being applied to journal bearings.

Journal Bearing Comparisons

In lubricated journal bearings of the primitive type (as already stated) the phenomenon of pressure oil film lubrication occurs naturally, due to the slight shifting of the centre of the shaft in relation to the centre of the brass, but its occurrence is much less marked in the case of bearings of large diameters, probably owing to the greater oil clearance that is necessary in large sizes and to the extreme thinness of the oil film. For example, a journal bearing of 2 or 3 in. in diameter will run satisfactorily under a pressure of 300 to 400 lb. pressure per square inch, but it is not found advisable to load large bearings above 100 lb. even with a forced oil circulation.

The pressure oil film only occurs along a narrow strip in the primitive type, and the remaining surface merely forms a brake on the rotation of the shaft, so that the designer is again restricted and can only reduce the pressure to the limit found safe in practice by increasing the length of the bearing. By sub-dividing the circumferential surface into a number of segments, each of which is pivoted at its back and thereby free to form an independent pressure oil film between its rubbing surface and the shaft, the number of the pressure oil films can be increased, so that the full projected surface of the bearings becomes effective for carrying load, and the brake surface is eliminated. The friction is thus reduced, the load-carrying capacity increased, and the bearing shortened.

Michell Journal Bearing Tests

A series of tests has recently been run on a Michell journal bearing by Cammell, Laird & Co., Birkenhead. Figs. 5, 6 and 7 show details of the experimental bearing, and Figs. 8 and 9 the method of testing it. As will be seen from Fig. 5, the bearing surface is divided into 12 segments, each of which is pivoted on a rib at its back, so that it is free to lift

at its leading edge to allow the necessary wedge-shaped oil film to form. These segments are shown in detail by Figs. 10 and 11. The faces of the segments or blocks are lined with white metal, each surface being 2 in. square, giving 48 sq. in. of rubbing surface, the equivalent projected area of each half of the bearings is 16½ sq. in.

In addition to the segments being free to tilt, the seat on which they rest is partly spherical, thereby making the bearing also a swivelling one. A circulation of oil was passed through the bearing, entering it between each pair of blocks from the chambers A and B, and escaping at D. The bearing was driven by means of an electric motor, and the ammeter and voltmeter readings recorded. Each run was continued until the temperatures of the oil were also recorded, together with the weight of the oil passing, and the revolutions per minute. The load was applied by adding weights to the scale pan H, shown in Fig. 9, the leverage being 11 to 1.

The annexed table gives the results observed, together with the friction calculated from the heat taken up by the oil. The friction is that for the two halves of the bearing pressed together. To get the coefficient of friction these figures require to be divided by twice the load.

TEST OF EXPERIMENTAL "MICHELL" JOURNAL BEARING. MAY, 1916.

Date and Duration of Test.		Total Load	Bearing Pressure	Revs. per Min.	Surface Speed	Amperes	Volts	Horse-Power Input	Oil Supply: Final Inlet Temp. F.	Oil Supply: Final Outlet Temp. F.	Oil Supply: Rise of Temp. F.	Oil Supply: Flow of Oil.	Friction Horse-Power from Heat to Oil	Coefficient of Friction	Actual Friction
Mar	Mins.	Lb.	Lb. per sq. in.		Ft. Min.				Deg.	Deg.	Deg.	Lb. Min.			Lb.
18	45	....	...	585	1,840	16.5	406	9.2	68	84	16	12.6	1.9	......	....
18	105	2,400	145	620	1,950	14.5	403	7.9	79	99	20	14.8	2.8	0.0099	47.5
18	105	3,600	220	615	1,930	16.0	395	8.6	84	101	17	14.3	2.3	0.0054	39.2
19	60	4,800	290	605	1,900	16.6	382	8.6	83	100	17	15.6	2.5	0.0045	43.7
19	40	6,000	370	615	1,930	16.9	395	9.1	84	102	18	17.6	3.0	0.0043	51.6
19	75	7,300	440	607	1,907	18.9	391	10.0	84	102	18	18.7	3.2	0.0038	55.4
19	45	8,500	520	605	1,900	19.0	395	10.2	83	99	16	19.0	2.9	0.0029	50.1
19	60	9,800	600	618	1,940	20.4	395	10.9	71	93	22	19.0	4.0	0.0024	67.6
20	90	11,700	700	611	1,920	21.0	391	11.1	76	100	24	19.7	4.5	0.0033	77.2
20	30	14,800	900	620	1,950	26.5	400	14.4	77	102	25	22.7	5.4	0.0031	91.7
24	30	....	...	1,315	4,130	23.0	390	12.2	76	95	19	23.0	4.1	......	....
24	60	2,400	145	1,320	4,140	27.8	392	14.8	74	96	22	26.4	5.5	0.0091	43.7
24	45	5,500	320	1,320	4,140	29.8	390	15.8	77	104	27	25.2	6.4	0.0046	51.1
24	60	8,500	520	1,303	4,100	40.0	398	21.6	82	117	35	33.0	10.9	0.0051	87.5
25	60	11,700	700	1,324	4,140	50.0	382	26.0	76	111	35	37.3	12.2	0.0042	98.3
25	105	11,700	700	1,317	4,140	42.0	390	21.2	73	112	39	31.2	11.5	0.0029	91.2
25	30	14,800	900	1,320	4,140	45.5	400	24.7	76	117	41	33.0	12.7	0.0034	100.4

A REMARKABLE SALVAGE

AN extraordinary story of the sea was told recently, in the Admiralty Court, to Sir Samuel Evans and the Trinity Masters. The plaintiffs were three of the crew of the steam tug Vigilant, of New York, who brought a claim of salvage on the ground that after the captain and the rest of the crew had deserted the vessel in a dangerous position off the southwest coast of Ireland, they remained on board and brought the vessel safely into Berehaven. The vessel was buffeted so violently by westerly gales on a voyage from New York to the Old Country that the captain eventually sent out the S.O.S. signal, and two days later (on October 29) decided to abandon the vessel. The second mate, it was stated, had made preparations for taking to the boats with the rest of the crew, when, as a last desperate resource, he appealed for volunteers to stay with him and endeavor to make the vessel weather the gale. The crew, sixteen in all, told him they were "not tired of life," and only two firemen stood by him. The rest went off to the Holland-Amerika liner Ryndam, which had hove in sight.

What the Captain Said

The three were left on board with, as the captain said, only enough coal for 24 hours. As he went over the side with his papers he warned the second mate he would never make port. If he did, he added, he deserved the ship and a gold medal as well. During their last day aboard, the crew had gone about their work in lifebelts. The second mate took charge, proceeding to the wheelhouse, and the firemen went to the engine and the fire. The weather grew worse. A particularly heavy sea jammed the steering gear, so that the port helm could not be used, and the cracking of the casting-head of the dynamo put the ship in total darkness. Approaching the Irish coast, she missed a reef by 50 feet. The intrepid three made the Cardiff Roads, their destination, as the sun was going down on the evening of November 9, having spent a fortnight in a craft half-full of water.

Vessel Worth $100,000

The legal position, it was urged by Mr. Laing, K.C., for the salvors, was that from the moment the crew decided to abandon the vessel their contract of service with their employers, the Bay Steamship Co., of America, was at an end, and the claimants were not servants of the company, but separate and unconnected salvors when they salved their own ship. The Vigilant was worth $100,000.

Counsel said the story was one which ought to live in the memories of mariners, who talked about such things and discussed deeds of daring at sea. These men staked their lives, all they had to stake, and had won the stakes they had played for. They had grasped the opportunity of their lives to make a substantial sum of money. There could not be a finer example of real salvage service. Every factor was there for enhancing the award. The ship would have gone to certain destruction except for what these men did. Sunday, 29th October, was well known to everybody in the Admiralty Court as the date of one of the fiercest gales of recent times.

The Judge.—Isolated as these men were, each of them at his post, it is difficult to see how they ever got food. They could not turn in to rest.

Mr. Laing said he had the notes of Greaser Welch on his experiences. They were remarkable. He (counsel) would not put them before the court as evidence, but he proposed to hand them to his Lordship afterwards to read.

In the end the court awarded £5,000 salvage as follows:—Fergusson, £2,500; Welch, £1,250, and Smith, £1,250.

International Mercantile Marine.—Until now (says a London correspondent) all the steamers for the International Mercantile Marine Co. have been built at Belfast on the "time and lime" principle, Messrs. Harland & Wolff charging the actual cost of construction and an agreed profit on their work. The combine, with which, I learn the Morgan interests are no longer connected, has been reorganized of late, and in conjunction with two other American concerns has bought the yard of the New York Shipbuilding Company. There, it is understood, most of the vessels will be built in future. If the United States Government can be induced to grant a sufficient subsidy it is intended to lay down four 25-knot liners of about 35,000 tons each and the contracts for two of them will be placed at Belfast.

Steam Saving Auxiliaries of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that steam-saving auxiliaries aboard ship continue to increase in number, and that they are being designed and constructed to meet, in the most effective manner, both ordinary and special service applications, this series of articles describing and illustrating at least the more important types of such apparatus seems to us more or less timely, both from the point of view of familiarizing engine and boiler room staffs with the products of different manufacturers, and that of their acquiring a closer intimacy with specific detail arrangement, relative to operation, maintenance and periodic overhaul.

STEAM TRAPS—I.

In most cases where steam is subject to condensation as in engines, pipes and various kinds of apparatus for power or heating, it is necessary to provide means whereby the water of condensation may be removed without any loss of steam. The device which accom-

FIG. 1. DUNHAM RADIATOR TRAP.

plishes this is known as a steam trap, and consists of a valve automatically operated by suitable mechanism, which in turn is controlled either by the weight or volume of water passing through the trap, or by the difference in temperature between the water and the steam.

The three principal types of traps in common use are expansion, float and bucket traps. Each of these types is made with numerous variations of construction. As will be understood, expansion traps operate as a direct result of temperature change, while float and bucket traps depend on the action of the water either by displacement in the float type or weight in the bucket type. Various modifications of each type are obtainable for different pressures, but contrary to expectation, low pressure traps have a higher percentage of failures than traps built for high pressures.

In selecting a steam trap for any particular duty, every effort should be made to ascertain the probable load with some degree of accuracy. Two lengths of pipe or two pieces of apparatus in different parts of the same plant may have very different rates of condensation unless every condition be exactly duplicated in each installation. As condensation is caused by loss of heat, the rate of condensation for any one pipe or heating system will depend on the pressure, manner of operation, and exposure so that the ratio of condensation per lineal foot may easily vary from a few ounces of water per hour to as much as thirty-five or forty ounces. Bearing these conditions in mind, it is well to provide a trap of sufficient capacity to take care of the worst conditions liable to occur.

The size of the valve orifice is an all important feature, and should be specified whenever conditions permit. Orifices are frequently much smaller than the pipe connection size, and when small enough to prevent the passage of grit or scale, cause trouble due to the valve not being able to seat properly, with resultant leakage of steam and wire-drawing troubles. Trouble is also liable to occur when the water arrives in irregular quantities, which overload the trap temporarily, although the total water per hour may be well within the trap's capacity. See, therefore, that the actual maximum capacity is equal to this maximum temporary load.

Low Pressure Traps

The development of the low pressure trap has been almost entirely in conjunction with vacuum steam heating. Vacuum heating was conceived when the effort was first made to utilize exhaust steam from engines, etc., for heating purposes. It was a well known fact that as much as 90 per cent. of the original heat contained in the steam before expansion took place in the engine still remained in the exhaust steam emitted from the engine cylinder.

There were many obstacles to overcome to reach the present-day efficiency of vacuum heating. First—It was necessary to transmit this exhaust steam to the various radiators and steam condensing units without producing back

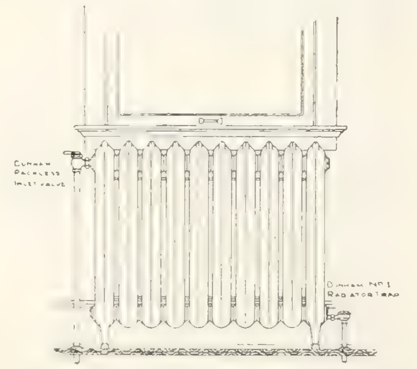


FIG. 2. INSTALLATION OF DUNHAM RADIATOR TRAP.

pressure upon the engine pistons. That meant that friction had to be removed. It meant that circulation must be induced by means other than by the engine itself. The idea was then conceived to suck the steam away from the engine and into the different radiating units. This was accomplished by means of the steam vacuum pump, the exhaust of the vacuum pump itself being carried directly into the same exhaust piping system as that the engine.

The application of the vacuum pump called for other vital improvements, the

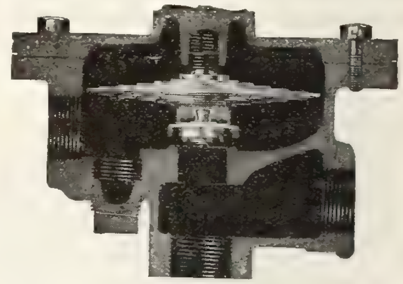


FIG. 3. DUNHAM BLAST TRAP.

most important of which was providing some suitable device on the return end of the radiator to keep the steam from blowing directly through into the return piping system, for this caused short-circuiting of steam through radiators in the direct path of engine to vacuum pump, and the other radiators would consequently air-bind and be very inefficient.

It was thus found after years of experimenting with hand regulated devices on the return of the radiators, with semi-automatic devices, etc., that the real success of the vacuum steam heating system depended almost entirely upon the correct selection of the trap to perform the function of releasing the water and air from the radiators and closing off tight against steam.

The trap must be of simple construction, must be automatic over a wide range of temperature so as to close off for steam and open for air and water—whether the steam pressure in the heatinging system be 10 or 15 in.. of vacuum or 5 or 10 lbs. of gauge pressure.

At the present time it is well understood that this is the real vital factor —that low pressure traps on vacuum heating must be capable of working automatically on this wide range, yet at the same time be capable of passing foreign matter easily and continuously from the radiator without clogging up.

The thermostatic type of trap is one of the most widely used traps for vacuum heating of any of the various types offered to-day.

Dunham Radiator Trap

This trap (see Fig. 1,) is commonly known as the hollow, corrugated, thermostatic disc type. The trap body and cover is made entirely of brass and is so simply constructed that the water from the radiator has a gradual and direct flow to the opening in the centre of the trap body which leads to the return pipe. Directly over this opening is the

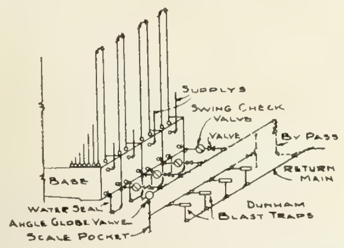


FIG. 4. INSTALLATION OF DUNHAM TRAPS ON BLAST COIL HEATER

only movable part of the trap. It is the member from which the trap derives its name — a hollow, corrugated, thermostatic disc, which is anchored rigidly to the cover of the trap. The corrugations in the disc add to the strength and the large diameter of the disc provides the maximum expansion of the disc with minimum strain per unit of area, with correspondingly long life.

The disc member contains a combination of volatile liquids which are hermetically sealed within and indefinitely retain their latent power of expanding and contracting in response to the effect of temperature. The disc is in contact with the steam and is subject to the same conditions that obtain within the heating fixture itself, an important factor in vacuum heating. On the lower portion of the disc is the flat valve which when steam surrounds the disc, seats on a flat surface of liberal area. The seat itself is raised slightly and this intercepts foreign matter, which usually collects around the raised seat until the trap opens, when all dirt and sediment is flushed through the discharge opening of the trap into the return pipe.

The disc forces the valve against its seat with a pressure of approximately 15 pounds which is sufficient to break up pieces of scale that might attempt to pass the trap. The large flat valve and seat admit of performing this severe service without injury to the seat, such as might happen to devices which use an otherwise sharp edge seat.

The disc member is made of a special phosphor bronze, and the same general design has been used by this company since the trap first appeared on the market some twelve years ago.

Dunham traps are made in the following sizes: ½ in. pipe connection, No. 1 size for 100 sq. ft. radiation; ½ in. pipe connection, No. 2 size for 350 sq. ft. radiation, the manner of installation being shown in Fig. 2.

The Dunham Blast Trap is constructed along the same lines as the radiator traps, except that it has an iron body. It is commonly used for removing air and condensation from steam mains or from blast heater coils.

The ¾ in. Dunham blast trap has a capacity for handling 1,500 square feet of direct radiation, and the 1 in. blast trap has a capacity for handling 3,000 square feet of direct radiation, or equivalent, a sectional view being shown in Fig 3, while Fig. 4 illustrates the method of application to blast coil heatters where exhaust steam is used in conjunction with a vacuum system.

PNEUMATIC GRAIN ELEVATORS

IN a recent paper by Cecil Bentham, M.I. Mech. E., read before the Manchester Association of Engineers on "Pneumatic Grain Handling Appliances," he said that the purposes to which grain elevating plants are applied were divided into the following three heads:—(1)—Discharging ships either to quay or to barges. (2)—Discharging barges at mills or granaries. (3)—Conveying grain long distances. The method of conveying the grain is to create a partial vacuum in a receiving chamber by means of an exhauster or pump. The air rushing along the conveying pipe carries with it a stream of grain from a nozzle at the free end of the pipe line depositing it in the receiving chamber at the other end. The grain is then discharged from the receiving chamber by means of some form of valve and is afterwards dealt with mechanically. The advantages of using a pneumatic plant in the first two methods mentioned, namely, for discharging ships or barges, were enumerated as follows:—

(a)—The amount of labor is considerably reduced as compared with other means of discharging grain, this being due to the fact that a pneumatic pipe will pick up nearly all the grain from the floor of the ship or barge without being "trimmed" as is necessary in the case of bucket elevators, grabs, etc. This avoids the necessity of engaging a large number of casual men when a cargo is being discharged.

(b)—It is healthier for the men engaged in discharging grain with pneumatic plants than with bucket elevators or other mechanical appliances. All grain contains dust varying in quantity and composition according to the condition or the part of the world in which the grain is produced; with ordinary buckets this dust is stirred up and permeates the atmosphere, and it is then breathed by the men who are working in it. The dust is deleterious to the men, dust from maize especially affecting the eyes.

(c)—By passing the grain through the pipes in a strong current of air it is aspirated, and if the temperature of the grain has risen on the voyage, the effect is to improve its condition. The vacuum is also supposed to kill weevils and mites, though the evidence on this point is not sufficient to form a definite conclusion at present.

(d)—Some amount of dust is also separated from the grain during its passage through the pipes, and may be discharged from the plant separately. This separation is taken advantage of in mills where the grain is used, but whilst in transit it is still unfortunately considered necessary to put all the dust back into the grain in order to avoid loss of weight.

(e)—With pneumatic tubes, the poop and bunker hatches may be discharged without any special scheming, because it is only necessary to pass the grain pipe down into the hold, and all parts of the hold may be reached even when difficult corners have to be negotiated. Where bucket elevators only are installed it is frequently necessary to discharge these holds entirely by means of hand labor.

(f)—Parcels of grain are sometimes separated by cloths, and in these cases the pneumatic method is the only one except hand labor which entirely obviates the risk of mixing.

(g)—Discharging can proceed in all kinds of weather, as it is only necessary to keep the hatch open sufficiently to operate the pipes.

(h)—The average capacity of a pneumatic plant is near its maximum capacity, whereas with the mechanical plant the average capacity is only a small percentage of the maximum capacity.

Power Feature in Pneumatic Plants

The author said that one of the early objections to the use of pneumatic plants was the comparatively large amount of power which was absorbed. In the early plants about 4 horse-power was absorbed per ton of grain per hour handled when discharging ships, w'

The power absorbed by a pneumatic grain-handling plant is extremely large in proportion to the actual work done. In a well-designed plant in fairly good condition the mechanical efficiency would only be from 5 per cent. to 6 per cent. This, the author said, was perhaps not a very satisfactory method of stating the power absorbed, because, theoretically, no work is done in conveying horizontally, and most pneumatic installations for discharging ships or barges inevitably involve the passing of the grain in a horizontal direction in addition to a vertical direction. If, however, pneumatic plants were compared with purely mechanical appliances, such as bucket elevators, which up to recent years were the most general method of discharging grain, it was found that the power absorbed by a pneumatic plant is still comparatively high. On the other hand, the bucket elevator for discharging ships is somewhat complicated, especially where large variations in height have to be dealt with, but when in good condition and working at a maximum capacity, it gives a mechanical efficiency of 50 to 60 per cent.; however, to obtain an average capacity equal to a pneumatic plant a bucket elevator would require to have a larger maximum capacity with consequent additional running losses.

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PRINCIPAL CONTENTS

STEEL, AND THE SHIPBUILDING OUTLOOK

ALTHOUGH the immediate outlook continues somewhat unsettled, the opinion is becoming more generally held that even should the United States enter the war arena on the side of the Allies, the industrial situation in Canada will be but slightly affected, if at all. At least, while the war lasts, and regardless of whether only preparedness or entry into the war be the ultimate outcome across the line, capacity business is assured for Canadian steel producers.

High steel prices are sure to prevail for the duration of the war, and on some products, particularly plates, for a considerable time afterwards. The demand for ship sections and plates is far in excess of present production, the mills having their output in various forms sold for the whole of this year. Prices, consequently, are very high, and the crest of the upward movement is not in sight. The ships lost during the war will have to be replaced; the outlook in the shipbuilding industry is thus exceptionally bright. The large number of ships now being built in the United States and Canada is largely responsible for the tight situation in the plates and shapes market. Canadian shipbuilders are participating to the fullest extent in the construction of new tonnage, the yards on both coasts and on our inland lakes being full up with orders. Notwithstanding the high costs of plates this activity is sure to continue until the shortage of tonnage has been well met. Getting plates, even at any price, is quite a problem.

Canadian shipyards may be said to carry on their books overload production capacity extending at least over the next two years. The need of both lake and ocean craft is most urgent, yet due to the abnormal steel situation, and the scarcity of skilled shipyard help, progress in construction has been up to present much restricted. The scarcity of ocean tonnage and the exceptional returns which are promised from investments in marine undertakings, promise a great impetus to the shipbuilding business in Canada. The need of ships is such that the Government in order to meet the demand, and to provide the bottoms necessary for the carrying trade has given tentative consideration to the matter, but no policy has yet been outlined.

There are two ways in which the needs of the situation may be met, either by the establishment of a state-owned shipbuilding industry or by giving Federal assistance by way of subsidy to private enterprises. Two private propositions have already been broached informally. Both of these contemplate the establishment of dry docks and shipbuilding plants at Halifax. Toronto interests are said to be behind one of the projects. Another proposal is the acquisition by the Government of a fleet of steel ships, a start already having been made in the purchase last November of two to operate between Atlantic and Pacific ports by way of the Panama Canal.

THE PORT OF HALIFAX, N.S.

THE big scale submarine activity developed by Germany against Allied and Neutral commerce on the Atlantic, has brought into well-deserved, although long overdue, prominence the port of Halifax, N.S., as a front rank ocean terminal. In a word, the Imperial authorities have determined that at Halifax the cargoes of vessels sailing from American ports to Europe are to be examined for contraband instead of at Kirkwall, Orkney Islands, off the North Coast of Scotland, in which latter vicinity, part of the danger zone is situated, and to reach which in any case means a considerable deviation from the regular sea route between New York and Liverpool. Little deviation is involved, we might say, in making Halifax the intermediary. The harbor of our chief Eastern port on the Atlantic is admirably adapted for the purpose, and with the extensive dock and terminal facilities now in course of construction, and which doubtless will be prosecuted with increased vigor towards completion, the minimum, and at most but temporary inconvenience may be anticipated in spite of the suddenness with which the decision was given effect. That its utilization as now determined will continue until the end of the war may be accepted without question, and that a fuller recognition of its Imperial and commercial value will be a peace-time development, there is also little doubt.

Marine News From Every Source

Montreal, Que.—Anglins, Ltd., has been awarded contract for a shipbuilding berth for the Canadian Vickers Co., Montreal.

Vancouver, B.C.—Plans are being prepared by the Amalgamated Engineering and Drydock Co. for a shipbuilding plant on Burrard Inlet. Estimated cost, $5,000,000.

Vancouver, B.C.—City Engineer Fellowes has prepared a report on harbor development in which it is suggested than an area of False Creek be retained for factory sites.

Ottawa, Ont.—The Government is advancing $1,500,000 to the Quebec Harbor Commission to enable it to go ahead with the system of harbor improvements now in progress there.

Toronto, Ont.—A bill will be submitted to the Provincial Legislature to empower the Board of Control to establish coal docks and storage at a total cost of $2,000,000.

Port Arthur, Ont.—Contracts have been awarded to the Barnett-McQueen Co., for the new Eastern Terminals' 2,000,000-bushel elevator, which is to be constructed on the waterfront.

Ottawa, Ont.—The supplementary estimates brought down in the House provide for the sum of $96,000 for the improvements at Port Stanley and for $36,000 for similar work at Port Burwell.

Victoria, B.C.—The keel for the fourth auxiliary schooner was laid at the Cameron Genoa Mill Shipbuilders, Ltd., shipyard, on Feb. 6, on the ways occupied by the schooner Margaret Haney, which was launched recently.

Victoria, B.C.—Yarrows, Ltd., of Esquimalt, have secured the contract for overhauling and repairing the Norwegian steamer Strinda. The vessel is now on her way to Vancouver from Vladivostok, under charter to the C.P.R.

Esquimalt, B.C.—Messrs. Yarrows, Ltd., have secured the contract for overhauling and repairing the American four-masted barkentine Puako, which arrived recently from Durban, South Africa, after a passage of 103 days.

Chatham, Ont.—Engineers Porter and Griesback, of the Department of Public Works, Windsor, Ont., have commenced the work of making soundings in the River Thames from Chatham to the lighthouse. The report is being prepared in connection with the proposal to dredge a fourteen-foot channel from Chatham to Lake St. Clair.

Port Arthur, Ont.—Ice conditions at this end of Lake Superior favor an early opening of navigation. Open water commences at Thunder Cape, 18 miles out. The weather has been cold, but high winds have kept the ice broken up.

The Taylor Engineering Co., of Vancouver, B.C., are handling the Bolinder crude oil engine which is built in Stockholm, Sweden. Twenty-four engines of this type have already been sold to shipbuilding firms in British Columbia.

Esquimault, B.C. — The municipal council has decided to memorialize the Provincial Government on the Esquimault drydock question, recommending that pressure be brought to bear upon the Federal authorities to have the undertaking carried out without further delay.

Vancouver, B.C.—John Coughlan & Sons have taken out a building permit for the erection of what practically completes their shipyards on False Creek. The permit which was issued by City Building Inspector R. A. McKenzie, provides for the erection of the machine shops and mould loft.

Midland, Ont.—A movement has been started to have a dry dock established here. In the furtherance of the scheme a deputation has visited Ottawa and asked for assistance in the work of dredging in connection with the proposed dry dock and shipyard.

Victoria, B.C.—The last concrete section of the parapet of the Ogden Point breakwater was laid on Jan. 22 and the structure, 2,500 feet in length, is now ready to be turned over by Sir John Jackson, Ltd., to the Dominion Government.

Victoria, B.C.—The City Council have passed a resolution that the Dominion Government be asked to arrange for trackage accommodation, car-ferry slips and warehouse accommodation on the new breakwater and piers at the Outer Docks, so as to equip the port with facilities to handle all the freight that might be offering at Victoria.

Port Arthur, Ont.—At the plant of the Western Dry Dock & Shipbuilding Co., work is now started on two more ocean-going freighters. Four more ocean-going freighters are to be built when these two are completed, and contracts for two more are now being arranged, making eight boats to be built in all. These freighters will be the same size as the Thorjerd and Blaamyra, recently launched.

Ottawa, Ont.—Hon Robert Rogers announced this month that the Norton-Griffith contract for the St. John harbor works, had been cancelled and a new contract was being prepared and tenders would be called immediately and work carried on as expeditiously as possible.

Ottawa, Ont.—Special harbor and river votes include one million dollars for Victoria harbor, B.C.; $750,000 for Port Arthur and Fort William harbors, and one million each for Toronto, St. John and Quebec harbors. The Quebec vote is for the construction of a dry dock.

North Vancouver, B.C.—The Wallace Shipyards have been awarded the contract for effecting the repairs to the G. T. P. steamer Prince John necessitated through the vessel's recent stranding in Wrangell Narrows. About 15 plates will have to be replaced and it is reported that slight injury to her engines and frames was sustained.

N.S. Schooner Launched.—The four-masted schooner Letitia Mackay was recently launched at Meteghan. It is the largest vessel of the year to be built in Nova Scotia. She is of 630 tons register. The vessel was built for Adam B. Mackay, of Hamilton, the contract for her building having been taken by Dr. T. H. MacDonald, of Meteghan.

Victoria, B.C.—It is feared that the British Columbia Salvage Co. steamer Pilot must have foundered with all hands. Twenty days have elapsed from the time the Pilot was dispatched from Salina Cruz on a voyage which usually takes 22 hours, and, although a large number of vessels have maintained a sharp lookout for the craft, her disappearance is still shrouded in mystery.

Vancouver, B.C.—Work will be commenced shortly on the construction of a big addition to the Great Northern Railway Co.'s dock at the foot of Campbell Avenue, the extension to cost in the neighborhood of $50,000. E. B. Ford, chief engineer of the Great Northern at Vancouver, announces that the work will be started as soon as permission to carry it out is obtained from Ottawa.

Russian Iron and Steel.—The production of pig-iron in Russia during 1915 was 4,062,100 tons, as compared with 4,769,300 tons in 1914. The output of semi-finished steel was 4,539,100 tons, as compared with 5,508,800 tons; and that of finished steel 3,590,500, as compared with 4,334,100 tons. Of the semi-finished and finished steel, 60 per cent. was

produced in Central Asia, while the Ural region made 20 per cent. Of the pig-iron made in Russia in 1915, rather more than 70 per cent. was produced in Central Russia.

Great Britain Building Small Freighters.—The new Department of Shipping, under Sir Joseph Maclay, is applying itself strenuously to organizing shipbuilding. All facilities are to be used for building small cargo boats in large numbers and turning them out quickly. Parts are to be standardized, and widely scattered facilities assembled at convenient centres, thus tearing another leaf from Germany's book.

Cunard Line Places Orders in U. S.—Contracts for ships to cost over $13,-000,000 have have been awarded the Harlan & Hollingsworth Corporation, of Wilmington, Delaware, by the Cunard Line and the United Fruit Co. It is the first time either concern has ever placed contracts with an American shipyard. The vessels for the Cunard Line are to be freighters of 15,000 tons capacity.

Panama Canal Passage.—The average time taken by a vessel to pass through the Panama Canal is 11 hours 40 minutes, according to the *Panama Canal Record*. The minimum time recorded is 7 hours 17 minutes, and the maximum is 1 day 8 hours and 10 minutes. The figures, obtained by observing 158 vessels passing through the canal, show that more than half of the ships were in the passage between 9 and 12 hours. Those requiring more than 12 hours numbered 48.

Transportation Co. Incorporation.—An announcement has been made of the incorporation of the George Hall Coal & Transportation Co., of Ogdensburg, with a paid-up capital of $1,750,000, to take over a fleet of steamers and terminals at Ogdensburg, Prescott, Ont., and Montreal, to transport soft coal between Lake Ontario and St. Lawrence River ports. John C. Howard, of Ogdensburg, will be president. Among the stockholders are L. W. Robinson, president of the Rochester & Pittsburg Coal & Iron Company; C. O'Donnell Iselin of New York, and George H. Clune, of Rochester.

Port of Montreal.—The annual report of the Montreal Board of Trade showed the trade of Montreal to be in an excellent condition. The figures of the trade of the port of Montreal show an unprecedented increase, the total exports amounting to $382,741,463, which, compared with $155,685,953 in 1915, show an increase of $227,055,510, or 145 per cent. This increased volume of business is in the main due to orders placed in Canada for munitions and supplies for the Allies. The imports amounted to $194,924,348, as against $115,919,977 the previous year, an increase of $79,004,371, or 68 per cent., which would have been considered extraordinary at any other time although by comparison with the increase in exports it is inconspicuous. The customs receipts in Montreal amounted to $32,-915,686, an increase of eleven million dollars over 1915, and of nearly seven million dollars over the highest figure hitherto, $26,016,631 in 1913.

Victoria, B.C.—C. C. Worsfold, Dominion Government district engineer, New Westminster, after an inspection of the Ogden Point breakwater has officially taken the structure over on behalf of the Government, and it only remains now for the contractors to erect the lighthouse at the outer end of the big 2,500 foot wall. It is understood that the contract for the 25-foot concrete tower which will house the big beacon will be signed up in the course of this month, after which work will be started immediately.

Victoria, B.C.—The Board of Trade and the Esquimalt Graving Dock Committee have both been working for some time past to induce the Dominion Government to accede to their proposal to have a dock built here, and the matter is at present under consideration at Ottawa. It has been strongly urged that it would be a great advantage and saving to have the work done by Sir John Jackson, Ltd., as it has its plant already on the ground and that concern's ability to handle the work at a minimum of cost is recognized by all.

Vancouver, B.C.—Active work on the construction of the proposed extension to the C. P. R. Co.'s Pier "D," at the foot of Granville Street, will likely commence in about a month, according to a statement given out by F. W. Peters, general superintendent at Vancouver. The pier will be made about 680 feet longer than it is now. The estimated cost of construction is in the neighborhood of $750,000. Work has already commenced on the preparation of the piles. They are being creosoted in North Vancouver.

Vancouver Harbor Expropriation. — The arbiters appointed in connection with the proceedings taken by the Vancouver harbor board to expropriate the Kitsilano Indian Reserve have handed down their award, naming $666,200 as the amount of compensation which should be paid by the Harbor Commissioners for the property. The Harbor Board had offered $500,000 for the Reserve, the Dominion Government set a value of $1,250,000 upon it upon the advice of their valuator, and some of the realty experts called to testify gave it as their opinion that in a competitive market with large corporations seeking it, the sum of $2,000,000 might be secured. The reserve comprises seventy acres within the city limits.

Excess Profits Handed Over.—In reckoning excess profits which the shipping companies will have to hand over to the Imperial Government, *Fair Play* takes the amount set aside by thirty companies—namely, 23 pounds 4 shillings per ton gross—and gives a total of sixty-four millions sterling as the contribution from twenty million tons of steam shipping, British owned. "This would indicate," says the paper, "that the total profits of shipping companies exceeded the datum line by about ninety-one and a half million sterling, equal to a dividend of nearly fifty per cent. on the pre-war value of two hundred million pounds. Shipowners, however, retain only about seventeen and a half million of this profit, out of which they have to set aside sufficient to cover the extra cost of building and repairs, which is now at a hugely inflated level."

Market for Ships.—A representative of a large shipbuilding company now in New York, says France and Great Britain are in the market for all ships the shipbuilding companies can turn out. This is the first time in history that Europe has asked this country to supply ship tonnage. American shipbuilding companies are crowded with work, and few ships can be built for foreign countries. The same shipbuilder says this country will be kept busy turning out ships at least five years after the end of the European war.

Vancouver, B.C.—It is announced that a large floating drydock is to be built here. The structure will be a 16,-000-ton double-section dock, capable of handling a boat of 18,000 tons, wihch is the measure of maximum requirements on the Pacific to-day. The company is the Vancouver Dry Docks, Ltd. A ship-repair and shipbuilding plant is a part of the plan decided upon. Contracts for construction and machinery are being let, and the company announces that it will have the dock in operation within a year. There will be subsidy aid from the Governments of both the Dominion of Canada and the Province of British Columbia, on the ground that the dock will be a commercial and naval asset.

Big Steamship Combine.—For the first time in the history of the world, one management alone controls over 1,500,-000 tons of British shipping; or, in other words, a twelfth of the British mercantile marine. To Lord Inchcape is due the enterprise which has brought about the fusion of interests of the P. & O., B. I. and the New Zealand Federal companies, whose fleets individually consists of ships of a gross total of 1,528,823 tons. The million-ton mark is passed by the Ellerman Lines, Ltd., whose total is 289 vessels of 1,310,362 tons. Just under the million mark is the Furness Lines, with 220 vessels of 920,424 tons.

Record Freight Rates.—The highest freight rates in history have developed in the past few weeks, with the result that it now costs $75 to ship a ton of copper to Mediterranean ports, as compared with a $4 rate in effect prior to the outbreak of the European war. Current agitation concerning renewed submarine activity has likewise added its mite to an already heavily burdened situation, with war risks quoted as high as 10 per cent. to ports along the Mediterranean. To French ports the steamship companies have raised their freight rates to $45 a ton, against from $2.50 to $3 in normal times. To other ports bordering on or near the war zone rates have been advanced commensurately with those noted above.

SHIPBUILDING AND SHIPPING—PAST AND FUTURE

WRITING in the *Trade Review*, of St. John's, Nfld., W. A. Munn reviews the shipping industry of Great Britain from 1701 to the present day. The article is entiled, "Trade After the War," and is in part as follows:—

In discussing this question for the future, it gives us a better idea when we make a few comparisons with the past, and also show the evolution of shipbuilding in Great Britain. In 1701, her private or mercantile shipping numbered 3,281 vessels, of a total burden of 261,222 tons. London took the lead with 560 ships, of 84,882 tons; Bristol coming next with 165 ships, of 17,338 tons, and Liverpool seventh on the list with 102 ships. Thirty years later, London had increased to 1,417 ships, ranging from 15 tons to one great ship of 750 tons, owned by the South Sea Co.; but the majority measured less than 200 tons.

In 1765, we read that Dutch, Danish, and Swedish ships were generally larger than the English vessels, and they had succeeded in ousting England as the carrier of the Mediterranean trade. Twenty-one years later, an Act was passed for the encouragement of shipping, and was followed by progressive acts of a like nature. In 1797, English and Scottish private vessels numbered 12,995, of 1,386,252 tons burden.

Early in 1800 the American shipbuilders laid themselves out to capture the Atlantic trade from Britain. With this object in view, ships of greater sailing power and greater carrying capacity were constructed, and were provided, in addition, with many labor-saving devices, which materially assisted their economy in working. The Americans were successful in their attempts for the Atlantic trade, and forthwith set themselves to gain predominance in the trade with China, for which they built vessels of unexampled speed. British shipbuilders being put on their mettle, eventually succeeded in building a class of vessels superior to anything at that time constructed; but a new era for ships and shipbuilding was near at hand.

The use of steam was becoming general. It was first confined to rivers, but was gradually expanding to ocean trade. In 1833, the Canadian steamer Royal William, made the voyage from Quebec to London in seventeen days, and in 1840 was founded the celebrated Cunard Steamship Co., with head office at Halifax, N.S. The nucleus of its fleet was four wooden paddle steamers, each of which was about 1,150 tons burthen. This was the first of the great trans-Atlantic steamship lines, that have developed into such magnificent proportions to-day.

Let us not, however, forget Sir Hugh Allan, who made such a name for the St. Lawrence Route. The Allan Line was the enterprise of one family. Capt. Allan and his five sons had devoted all their energies to develop Canadian trade. For forty years they ran a line of sailing ships to Montreal. In 1852 the Canadian Government requested tenders for a weekly mail steamship line. The tender of Sir Hugh Allan was accepted, and this famous steamship line came into existence.

England was now supreme, and quickly increased her steam-propelled vessels. This led to the establishment of coaling stations in distant parts. The construction of the Suez Canal and other short cuts were found very suitable to steamships, and she quickly secured the ocean-carrying trade of the world. The following records of Great Britain speak louder than words as to the possibilities of steamship building:

Year	Steamers	Net Tonnage
1830	298	30,339
1840	771	87,928
1850	1,187	168,474
1870	3,178	1,112,934
1900	9,209	7,207,610
1907	11,394	10,023,700

Year	Sailing Vessels	Net Tonnage
1830	18,876	2,171,253
1840	21,883	2,680,334
1850	24,797	3,396,659
1870	23,189	4,577,855
1900	10,773	2,096,489
1907	9,648	1,461,490

From Lloyd's list of October 12, 1916, I take the following extract on shipbuilding returns to September 30:—

"In the United Kingdom, only one wooden sailing vessel is being built, and she is 100 tons gross; only four steel sailing ships, with tonnage of 900 tons for the last three months; seven steel sailing ships for the last six months; total tonnage, 1,478, or equal to 200 tons each. There are under construction at the present time 465 steel steamers, of which 240 of them are over 4,000 tons each."

Newfoundland Shipbuilding

Regarding shipbuilding in Newfoundland, in 1612 we havethe record of John Guy, her first Governor, building his "Banke Shippe of fifteen tons" at Cupids, which he called Ye Endeavor, which should still be out motto for greater exertions in this business. Statistics are very deficient, but it is well known that many fine vessels have been built in Newfoundland. Vessels were built at Labrador that sailed round Cape Horn to Australia.

Seal fishing first started with small, open boats and nets, but about 1800, locally built, strong, "Western boats" (as we call them), were first brought into use. About 1819, the first 100-ton vessel to prosecute the seal fishery — the Four Brothers—was built at Brigus, and two years later the "Experiment," 108 tons, was built at Carbonear. From this time forward many vessels of 100 to 300 tons were built for the seal fishery and foreign trade.

With the exception of catching fish, we must all acknowledge that shipping is the most essential thing in the whole existence of Newfoundland, as we have to export and import nine-tenths of our produce and requirements, respectively. From the latest customs records we find that Newfoundland owns 3,310 sailing vessels of 130,606 tonnage; 92 steamers of 20,875 tonnage, or a total tonnage of 150,955, ranging from 15 tons to one vessel of 3,345 tons.

Comparing these figures with Britain, we have nearly double the tonnage of London two hundred years ago. It shows the possibility of expansion in shipping, if we only go at it in the right way.

The Maritime Provinces of Canada played a very important part in shipbuilding sixty years ago, when their wooden ships, manned by their own sailors, were found in all parts of the world. At that time Nova Scotia owned more tonnage per capita than any other country in the world. The new era of iron shipbuilding drove this class of vessel out of existence, but now that the smelting industries of Cape Breton have developed to such a large extent, every effort is being made to revive this industry with steel ships.

The important question for Newfoundland is how we can progress on like lines, for it must be plain to every one that its destiny lies in that direction, when we consider in a practical way, the results to all other nations. Before many years are over, we will find one of the greatest iron shipbuilding yards on this continent situated in Sydney Harbor. These will of course be dependent on Newfoundland for iron ore, but we will be dependent for coal, unless able to produce some other material for fuel to localize smelting.

AUTOMATIC BOILER FEED-WATER REGULATORS

IN order to have satisfactory and safe operation of a steam boiler, it is absolutely necessary that the water level be maintained within certain limits. If it be possible to accomplish this by means of some reliable mechanical device, instead of relying upon the constant attention of a fireman or water-tender, who is human, and therefore liable to make mistakes, the advantage is apparent, from the point of view both of safety and of economy of labor. As a result, a number of different devices have been developed, whose object is to control automatically the flow of feed water into a boiler, so that the water level will be maintained within certain predetermined limits. These devices are called automatic boiler feed-water regulators and they seem to have a very high degree of reliability. Many advantages are claimed for them besides those already indicated, chief among which is increased boiler efficiency due to their use.

If, in addition to the automatic feed-water regulator a high-and-low-water alarm is installed, the danger of high or low water is reduced to a minimum, for, in case the automatic regulator fails to operate properly, the fireman's attention is called to that fact by the high-and-low-water alarm, and he can then control the feed by hand until the trouble with the regulator has been overcome.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Duncan B. Ellis, a veteran Windsor lake captain, was knocked off the car ferry and drowned on Jan. 22.

Captain John E. Tobin, a veteran of the Civil War, and for many years master of vessels, died at Windsor, Ont., on Jan. 22.

Harry McLaughlin, surveyor of customs at Montreal, has been appointed shipping master of that port in succession to R. S. White, resigned.

E. L. Cousins, chief engineer of the Toronto Harbor Commission, has been elected president and **J. R. W. Ambrose**, chief engineer, Toronto Terminal Railway Co., vice-president of the Engineers' Club, Toronto.

Capt. Reginald B. Bassett, member of the Lake Masters' Association, died at the residence of his parents, 24 Tyndall Avenue, Toronto, on February 17. He was born at Collingwood, Ont., 33 years ago. Previous to sailing the Mariska for the Bassett Steamship Co., he was master of the J. A. McKee, belonging to the Western Steamship Co.

Captain Robert A. Bartlett, Peary's navigator of the Roosevelt on the successful expedition to the North Pole in 1909, will go again into the Arctic Ocean in 1918, and is now preparing plans for a wooden ship, 135 feet long, to be built in one of the yards on the Pacific Coast. Bartlett will inspect the yards on the Pacific this spring and select a site for the building of his vessel.

Capt. W. T. Turner was in charge of the transport Ivernia when she was torpedoed on New Year's Day in the Mediterranean by a German submarine and sunk with a loss of 120 officers and soldiers and 33 of her own crew. He, it was reported, remained on the bridge until all the troops and his own crew had got away in the lifeboats and rafts before striking out to swim as the vessel went down under his feet. The majority of the crew lost were firemen who were killed when the torpedo exploded inside the Ivernia close to the stokehold. Captain Turner had only just joined the Ivernia, having left the Ausonia in London at short notice and traveled overland from Havre to Marseilles, where the transport was taking on troops and stores. He told the officers on the Ivernia how lucky he had been on the eastward voyage of the Ausonia from Montreal to London in escaping being torpedoed by a German submarine five miles off Ushant by an hour and a half. He steamed through the wreckage of an 8,000-ton French freighter, which was only six miles ahead of him, he said. Captain Turner is an expert swimmer, and was over three hours in the water when the Lusitania was sunk off the southwest coast of Ireland on the afternoon of May 1, 1915.

Vancouver, B.C., No. 7, N.A.M.E.—Council No. 7, Vancouver, has elected the following officers for the year 1917: President, I. N. Kendall; 1st V.P., Joseph Dick; 2nd V.P., R. G. Bell; Secy.-Treas., Ephraim Reid; Conductor, Lorne A. McAlpine; Doorkeeper, Leslie H. Clark; Auditors, John I. Marshall and John Ross; Council, I. N. Kendall, E. Reid, John Johnston and Frank Creeden.

Kingston, Ont., No. 4, N.A.M.E.—At the last meeting, the following officers were elected and installed:—President, W. McWilliams; 1st V.P., J. Lentz; 2nd V.P., R. Vence; Conductor, George Jarrell; Doorkeeper, M. Sullivan; Secy., James Gillie; Treasurer, J. F. McEwen; Committee, T. Bishop, George Boyd, J. Gillie, J. F. McEwen, and Wm. Dunnigar; Hall Trusteer, J. F. McEwen and James Gillie.

Champlain, Que., No— N.A.M.E.—A new subordinate council of the National Association of Marine Engineers has been organised at Champlain, P.Q., the charter membership totalling 40. Officers for 1917 have been elected as follows:—President, Noe Chartier; 1st V.P., Albert Carpentier; 2nd V.P., Ernest Sauvageau, Secy., Arthur Arcand; Asst. Secy., Doz. Vezina; Treasurer, Ben Marchand; Conductor, Pierre Brunelle; Doorkeeper, Arthur Petit; Auditors, Maz. Marchand and Tanc. Chartier; Councillors, Thos. Fugere, Ald. Fugere, Ulp Rivard, Don Morinville, Sam Brunelle.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. A. Wright, Toronto. **Secretary**—Francis King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B.; Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I. Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

1917 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand,	93 Fifth Avenue, Lachine, P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	176 King Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

St. John, N.B., No. 2, N.A.M.E.—The following officers have been elected for the ensuing year:—President, T. B. Whelpley; 1st V.P., W. Prince; 2nd V.P., H. S. Cowan; Secy., G. T. G. Blewett; Asst. Secy., Arthur Ross; Treasurer, W. B. Parks; Conductor, G. L. Belyea; Doorkeeper, G. C. Buller; P. Pres., W. L. Hurder; Auditors, N. J. Morrison and W. Prince, Council, Messrs. Whelpley, Ross, Hurdie, Blewett and Cowan.

Marine Association Annual.—The annual meeting of the Dominion Marine Association was held during the month at the King Edward Hotel, when the following officers were elected:—President, A. A. Wright, Montreal Transportation Co., Toronto; vice-presidents, Messrs. J. T. Mathews and A. E., Mathews, Mathews Steamship Co., Toronto; secretary, Francis King, Kingston, Ont. The reports presented showed all the lines to have had a prosperous year. Among those present were Captain Jas. B. Foote, Toronto Insurance and Vessel Agency; Capt. Bassett, W. L. Reed, Canadian Northwest Steamship Co.; George Farrar, Farrar Transportation Co.; John Donnelly, Kingston; W. McCormack, Algoma Steamship Co. and E. W. Stith, Buffalo.

SHIPPING FEDERATION OF CANADA ANNUAL MEETING

AT the 14th annual meeting of the Shipping Federation of Canada, held recently, Col. Andrew A. Allan was re-elected for his seventh term as president. At the same time a resolution was passed expressing appreciation of the long and valuable services rendered the Shipping Federation of Canada by Col. Allan, and by his family, who have been so closely identified with the Canadian shipping business for three generations. Unfortunately, Col. Allan was unable to be present, owing to illness, and the chair was taken by the vice-president. John Torrance, of the White Star-Dominion Line.

The reports presented showed a net increase in tonnage during the year of 164,252. This was due to a marked increase in tramp vessel arrivals. The regular line tonnage entered with the Federation during the season of 1916 showed a decrease of 35,434 tons, owing to the exigencies of war service, but the tramp tonnage entered showed an increase of 199,686 tons, which more than made up for the loss of regular line tonnage. The figures for this service are as follows:—

	1915	1916	Tons.
Regular line tonnage	510,070	474,636	*35,434
Tramp tonnage ...	299,627	499,313	†199,686

*Decrease. †Increase.

	Tons.
Total tramp tonnage, increase	199,686
Total regular line tonnage, decrease	35,434
Net increase in tonnage . . .	164,252

Officers for Ensuing Year

Officers and executive were elected, as follows: Colonel Andrew A. Allan, president; John Torrance, chairman, executive council: J. R. Binning, treasurer; E. W. Foulds, assistant treasurer.

Executive Council:—Colonel Andrew A. Allan, W. R. Eakin J. R. Binning, R. W. Reford, D. W. Campbell, John Torrance (chairman), A. H. Irving, A. MacKenzzie.

Sub-Committees

Bill of Lading—Colonel W. I. Gear, John Torrance, J. R. Binning and D. W. Watt.

Harbor Equipment—Colonel Andrew A. Allan, Colonel W. I. Gear and John Torrance.

Manager and Secretary, Thomas Robb.

Quebec District Committee:—William Macpherson (chairman), Harold Kennedy, S. Barrow and G. B. Ramsay (secretary).

1916 an Erratic Season

The reports presented showed that it had been a most erratic season, owing to the taking over of so much tonnage for war service, and the great demands for war supplies. High rates had continued in effect throughout, while at times it had been found necessary to charter outside vessels at abnormal rates to meet the demands of exporters.

Notwithstanding the volume of trade carried on during the season, and other difficulties incidental to these times, it was stated that speedy despatch had been given all vessels entering the harbor, and no detentions or congestions for any great length of time had occurred.

Exports from Montreal had shown abnormal increases in certain articles, notably in grain, with an increase of

28,490,000 bushels; flour, 2,962,775 sacks; eggs, 93,416 cases; cheese, 290,-968 boxes; and butter, 122,694 boxes. On the other hand, decreases in exports were noted in hay, 740,434 bales, and apples, nearly 20,000 barrels.

Annual Report

In his annual report, Col. Allan set forth that: "The first ocean vessel to arrive from the sea was the Italian SS. Bayern, on May 1, three days later than the first arrival in 1915. The last ocean vessel to depart was the Norwegian steamer Begna, with a full cargo of grain for the Belgian Relief Commission, which cleared on the morning of December 3. Vessels from the upper lakes passed through the harbor, outward bound, as late as the middle of December.

"The number of ocean vessels which arrived at Montreal during the season was 685, a decrease of 130 as compared with last year. The number of trans-Atlantic vessels which arrived showed an increase over last year, but a serious falling off is recorded in coasting trade vessels. This decrease was principally due to the scarcity of ocean tonnage at present, vessels which formerly plied on the coasting trade having in considerable number left for other trades where higher rates are prevailing.

"The passenger trade, both eastbound and westbound, was as good as could be expected; in fact, most of the passenger vessels on the route this year were at time overbooked on their eastbound voyages.

Improved Pilotage

"The standard of the pilotage district below Quebec, I am pleased to state, has improved considerably during the past year. This is no doubt due to the energetic measures taken by the Government to put the district on a sound footing, and it is our earnest hope that they will keep up this good work, and help to efface the black marks which this district has placed on the route.

"The list of accidents on this route, published in the body of our report, seem very large as compared with former years, but I assure you, with the exception of one or two cases, they were not of a serious nature, most of the vessels only suffering minor damages."

After dealing with various port and channel matters, the report concludes with the statement that:—

"During the course of the year recently closed, I am pleased to say that our relations with the various Government departments, as in the past, have been most cordial, and our hearty thanks are due to the Hon. J. D. Hazen, Minister of Marine and Fisheries; his deputy, Alexander Johnston and G. J. Desbarats, C.M.G., Deputy Minister of the Naval Service, for their prompt and courteous attention given to all matters which we had the occasion to bring before them during the past year.

"Our thanks are also due to Quartermaster-General D. A. MacDonald, Brig.-General J. Lyons Biggar, director-general of supplies and transport, and the other members of the War Council for their courtesy and co-operation in the many matters that we brought before them during the past year.

"I take this opportunity of thanking the members of the executive council for their assistance and support during the past year."

GREAT LAKES WAGE SCHEDULE FOR ENGINEERS

THE following minimum wage scale and classification for engineers operating on the Great Lakes was adopted by the Great Lakes' Executive Committee at their Annual Meeting, held in Toronto, on January 4, 1917, representing Port Arthur, Sault Ste. Marie, Collingwood, Owen Sound, Midland, Toronto and Kingston Councils, and approved by the National Executive Committee, same to be effective during the season of 1917, or until revised or amended by the Lake Executive Committee. The classification and schedule does not apply to certain ferry steamers, where special arrangements may be necessary, or to superintending engineers. All reference to tonnage to be constructed as gross tons. With reference to employment, transportation, board, etc., 1916 conditions to prevail.

Passenger Steamers

Class No. 1.—All passenger steamers of 3,500 tons or over, chief engineers, $1,800.00 per season; second-engineers, $125.00 per month.

Class No. 2.—All passenger steamers of 1,250 tons and under 3,500 tons, chief engineer, $1,600.00 per season; engineer, $110.00 per month.

Class No. 3.—All lake passenger steamers under 1,250 tons and all passenger steamers confined to river service requiring second class engineer, chief engineer, $1,400.00 per season; second enginner, $90. per month.

Class No. 4.—All passenger steamers from 45 N. H. P. to 25 N. H. P., chief engineer, $120.00 per month; second engineer, $80.00 per month.

Class No. 5.—All passenger steamers under 25 N. H. P. chief engineer, $100.00 per month.

Freight Steamers

Class No. 1—All freight steamers, 6,000 tons and over, chief engineer, $1,-800.00 per season; second engineer, $125.00 per month.

Class No. 2—All freight steamers of 3,000 tons and under 6,000 tons, chief engineer, $1,600.00 per season; second engineer, $110.00 per month.

Class No. 3.—All water bottom freight steamers under 3,000 tons requiring second class engineer, chief engineer, $1,400.00 per season; second engineer, $100.00 per month.

Class No. 4.—All freight steamers not included in Classes 1, 2 and 3, and requiring second class engineers, chief engineers, $135.00 per month; second engineer, $90.00 per month.

Class No. 5.—All freight steamers, 250 tons or over and requiring third class engineer, chief engineer, $110.00 per month; second engineer, $80.00 per month.

Tug Steamers

Class No. 1.—All tug steamers requiring second class engineer, chief engineer, $135.00 per month; second engineer, $100.00 per month.

Class No. 2.—All tug steamers from 75 N. H. P. to 30 N. H. P., chief engineer, $125.00 per month, second engineer, $95.00 per month.

Class No. 3.—All tug steamers under 30 N. H. P. requiring licensed engineer, chief engineer, $110.00 per month; second engineer, $85.00 per month.

COMING SEASON LAKE VESSEL SCARCITY

SMALL carriers and boats for special trades will be scarce during the coming season, as, in addition to vessels of that class lost during the past two years, 98 were sent to the coast. The total tonnage of lake boats taken to salt water was 174,476. That figure, however, does not include a number of steamers which have been sold to eastern owners, and will leave the lakes this year. Thirty-eight Canadian steamers, of 73,771 gross tons, were sent to the coast since the buying movement started in 1915. Since that time 39 American steel steamers, of 75,398 tons; three American iron steamers, of 5,878 tons, and 18 American wooden steamers, of 19,429 tons, left the lakes.

Thirty-two lake steamers were taken over by English owners, and nine steamers were purchased by the French Government. A large number of new vessels were turned out on the lakes for coast service, and, during the past eighteen months, American shipyards built vessels of 208,000 gross tons to foreign order. A number of lake boats that were taken to the coast have been lost.

The shifting of so much tonnage will mean that capacity for grain and coal will be cut quite a bit, as most of the vessels now sold were operated in the latter trades. There are only a few American steel steamers of Welland Canal size left on the Great Lakes, and the supply of Lake Ontario tonnage will be short of the demand.

Licenses for Ships Leaving Canada.—The situation caused by the German submarine blockade is being given consideration as far as the sailing of vessels of Canadian register are concerned by a ship licensing committee appointed by the Government to control Canadian steamship transportation. The committee is composed of Alex. Johnston, Deputy Minister of Marine; F. C. T. O'Hara, Deputy Minister of Trade and Commerce; Commissioner of Customs McDougald, and G. J. Desbarats, Deputy Minister of Naval Service. The committee has issued scores of license during the time it has been in control. No ship is allowed to leave Canada without such license and no license is given unless the committee is assured the vessel's trip will perform the most useful possible service to Canada and the Allies in view of the shortage of tonnage.

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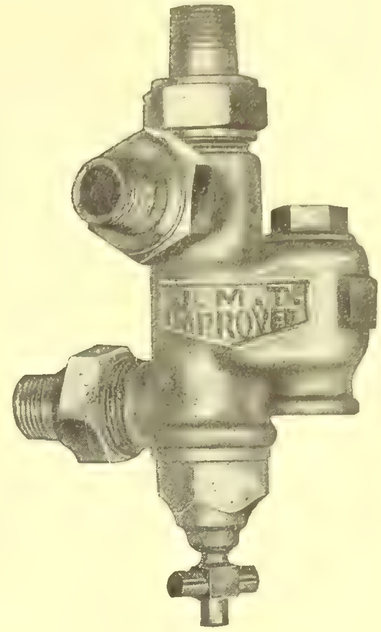

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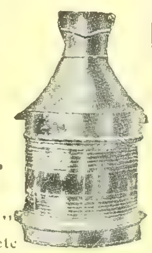

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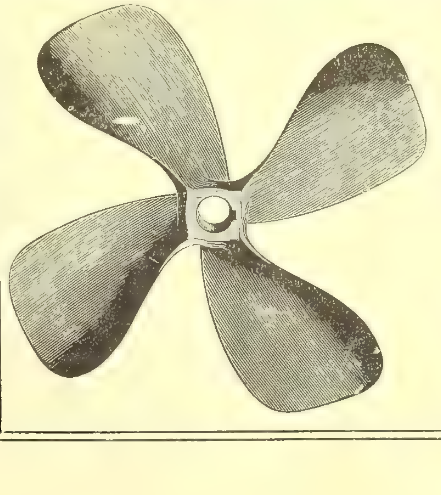

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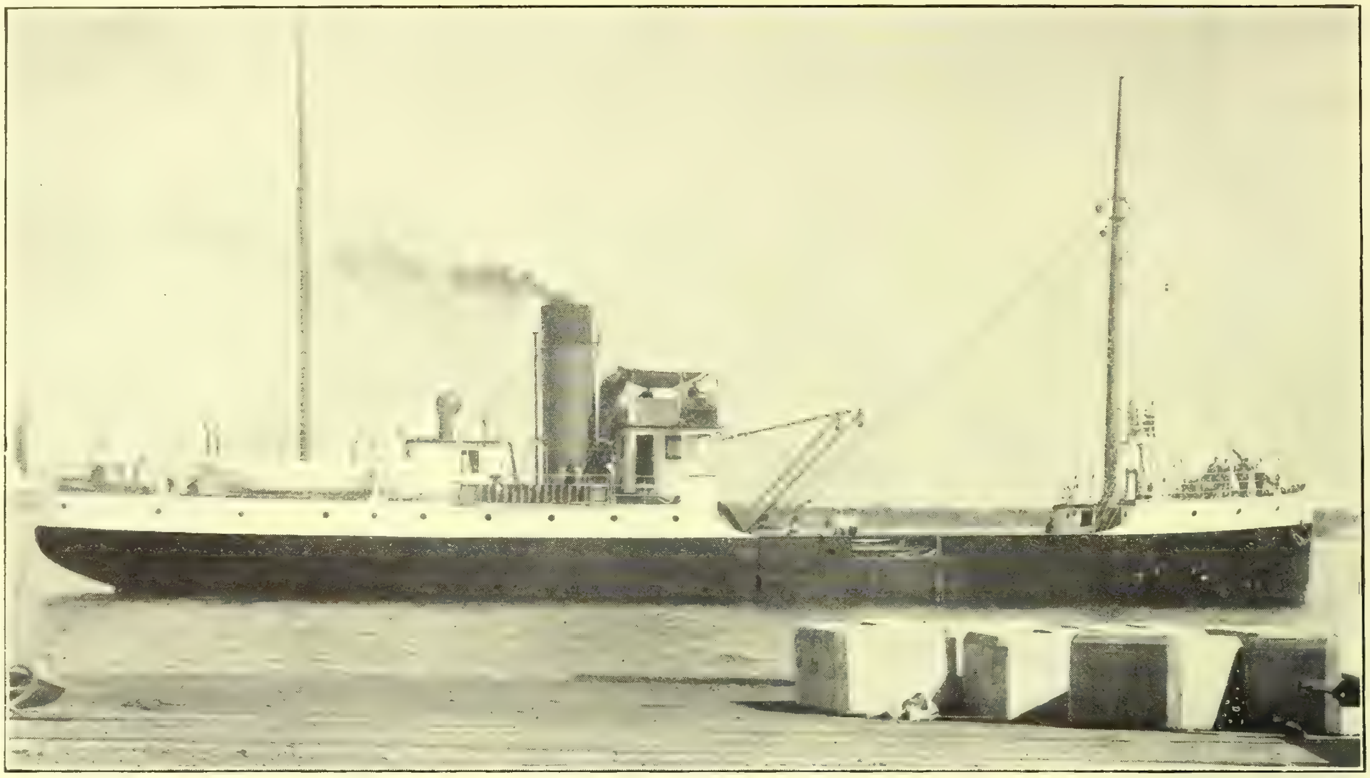

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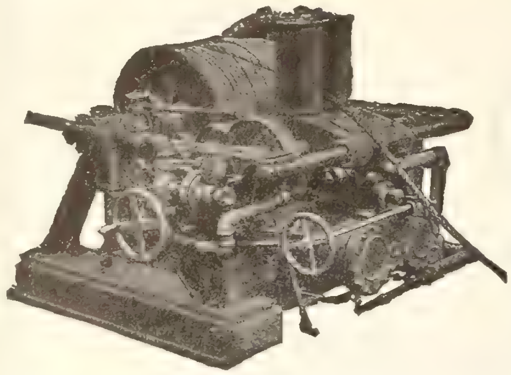

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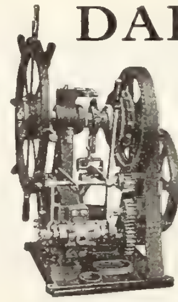

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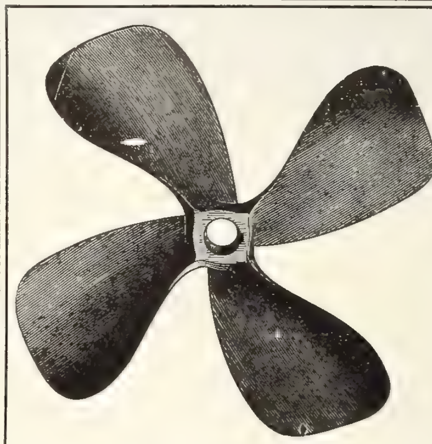

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High Pressure Steam Stop Valve Design and Construction*

By D. McNicoll

In what follows, investigation is made of various designs of steam stop valves, particular attention being given those accessory details which contribute to the general efficiency and operation safety of each individual unit, whether for service ashore or on board ship.

IN designing high-pressure steam stop valves, the essentials to be observed are tightness, reliability, simplicity, and safety. In small sizes not exceeding 4 in. or thereabouts and of single-beat type, these essentials are obtained without much call for special consideration, but as the sizes increase the design demands careful attention. In the succeeding columns an investigation of the various designs is contributed, and prominence given to details which affect what might be termed the general efficiency and safety of the fitting.

Fig. 1 shows a type of single-beat unbalanced stop valve frequently used as a boiler stop. The same design in more or less modified form is used throughout most main steam-pipe systems, being met with as an intermediate shut-off or bulkhead stop valve. The valve shown is of 8 in. diameter, the material of chest being cast-iron, internal parts gunmetal, and the working pressure 200 lbs. per square inch. In many instances chests of this size and for this pressure are made in cast steel, but provided the design is carefully observed the choice of material is optional. For larger sizes or higher pressures cast steel is desirable. Independent of pressure, wherever superheat is present, cast steel is essential, and the internal fittings in this instance should be of a high-tension bronze, perferably a nickel alloy.

The features in the design which call for special attention are stresses in the chest due to pressure; stresses due to hardening down; stresses due to expansion of spindle with valve shut; tendency of valve to rotate when steam is flowing through; liability to fracture of seat studs. In settling the thickness of body metal, the general method is to ensure that the aggregate section is such as to allow of a safe stress per square inch of section, but on investigation it is readily admitted that all parts are not equally stressed.

In Fig. 1, assuming that the pressure is present throughout the chest and acting at right angles to the plane of section shown, the stress on the part lettered A is much higher than on the other portions. By way of illustration:—The pressure on the upper half of the outlet and half the cover is approximately 8,950 lbs.; which stresses the section on the top left-hand side to 1,061 lbs., per square inch, whereas the average stress for the aggregate section is only 891 lbs. The cover, of course, takes a portion of the stress due to frictional resistance, and the tighter the cover nuts are screwed up, the greater the assistance given to the weaker section. In a sense this is "robbing Peter to pay Paul," as it simply puts up the stress on the studs.

The stresses resulting from excessive hardening down are in many instances exceptionally high, as is often proved by the burst condition of valve lids. This hardening down is due to an attempt to overcome leakage. It appears providential that the valve lid gives way in nearly every case, or otherwise there might be far more fatal accidents in this connection. Steel crossheads and turned pillars should always be fitted in preference to cast bridges, the latter being anything but safe, particularly in the larger sizes. There is no doubt that in valves over 4 in. diameter a great benefit accrues from the adoption of a flexible seating in conjunction with the solid face. This was introduced by R. R. Bevis, J. H. Gibson and Cockburns, Ltd. With this arrangement leakage from distortion is obviated, and, in addition, there are two faces, so that if one is leaking from any cause of distortion there is always the other one to fall back upon.

FIG. 1

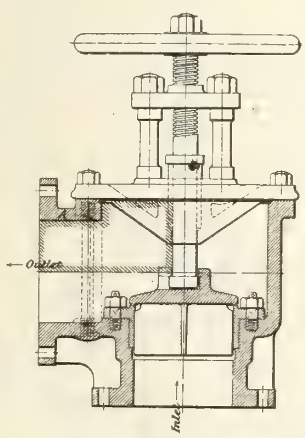


FIG. 2.

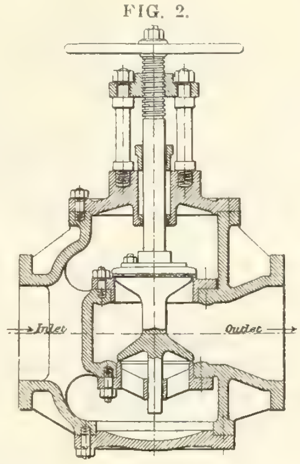
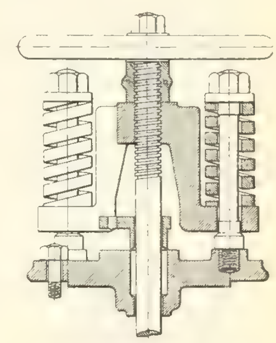


FIG. 3.



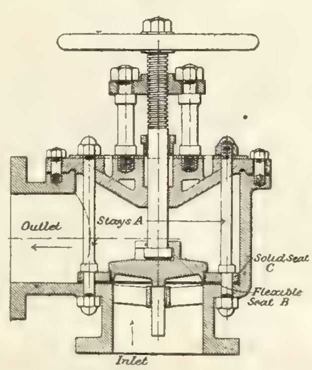


FIG. 4.

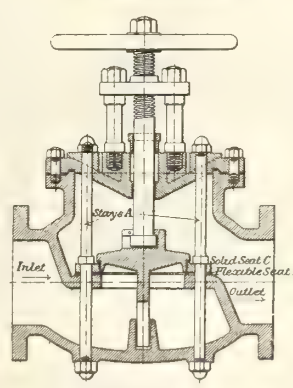


FIG. 5.

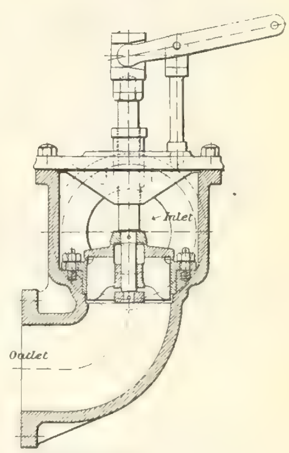


FIG. 6.

Shutting Down Hard When Cold

Another source of high stress is when the valve has been shut down hard when cold, and afterwards steam from other boilers admitted to the top of the body. Even with steam in the inlet side only a fair degree of heat is transmitted to the spindle. In each case the subsequent tendency to expansion puts a stress on all the parts. An actual experience of the author is illustrated in Fig. 2. This was a double-beat type of valve and the bottom seat was attached as shown. The valve was hardened down for a steam test, with the result that after the test a number of the manganese bronze studs from the bottom seat were found lying broken in the bottom of the chest, and all showed signs of fracture, the expansion of the spindle having caused this.

Apart from this, the design of seat is not to be recommended even if the studs do not give way, as the tendency thereby is to cause a leaky joint between chest and seat. Seats should be arranged where valves have to be hardened down so that this hardening tends to make the joint tighter, that is to say the gunmetal seat should be upon the top of the steel seat, and not below it as shown. One method of counteracting the damage from expansion is by fitting a spring crosshead. This is shown in Fig. 3, and is loaded generally from $1\frac{1}{4}$

*From a paper read before the Institute of Marine Engineers.

to $1\frac{1}{2}$ times the boiler pressure per square inch of valve area, and a higher load than this cannot be put upon the valve spindle, no matter what purchase is used. In Fig. 1 stays are sometimes fitted as shown dotted. These only serve to stiffen the cover and, as will be noticed, still further reduce the section of metal at an already weak section.

The rotation of winged valves when steam is flowing is due either to a slight angle on the wings or to eddies in the steam. The valve can be prevented from rotating but to do this a pin must be fitted or other means adopted. The damage done to valves from this rotation is hardly credible, and calls for the adoption generally of pintle or centre-guided valves.

Valve Seat Fixing

The source of much trouble is the fracture of seat-securing pins or studs. In the large sizes it is quite inadmissible to drive the seats in and secure them by means of a pin or pins through the side of the chest and it is absolutely prohibited in all sizes when superheated steam is present, experience showing in this case that seats driven and secured by side pins become quite slack and allow leakage to occur. The seats in larger sizes are therefore secured in the manner shown in Fig. 1. The only way to avoid serious trouble with this design is to run a wire through the heads of all pins or through split pin holes, if studs are fitted. This prevents the fractured portions being carried to some part where serious damage may be caused.

The question of draining generally cannot receive too much attention. and means should always be provided for efficiently getting rid of all water in both inlet and outlet before a valve is opened.

In Fig. 4 a type of valve is shown which it is suggested is an improvement on that shown in Fig. 1. The first feature that attention is desired to be drawn to is the method employed so that the cover may take up a share of the bursting pressure which acts at right angles to the axis of the spindle. This consists of a tapered spigot on the chest with a corresponding tapered recess in the cover, making a metal to metal joint. The stresses from hardening down and expansion are mainly taken up by the four stays A, which also serve to secure the seatings. With this arrangement no loose parts are situated inside the chest, with the consequent prevention of damage from this source. The valve is centrally guided thus preventing rotation. A flexible seating is shown at B and when this and the corresponding valve face engage, the solid seat C and its corresponding valve face are 1-100 in. open, so that when this latter seat and face engage the flexible seating is deflected 1-100 in. Fig. 5 shows the same design of valve as in Fig. 4, but of straight through or globe type; the design calls for the same attention as in the previous case.

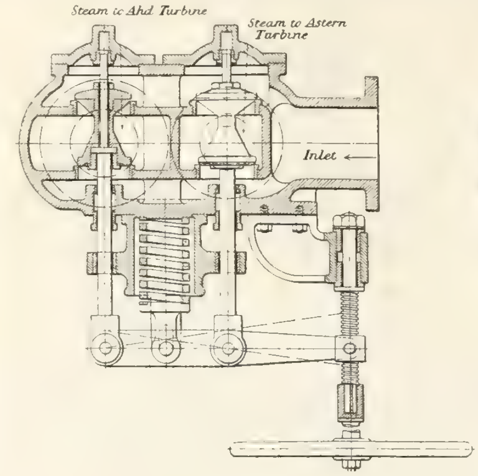


FIG. 8.

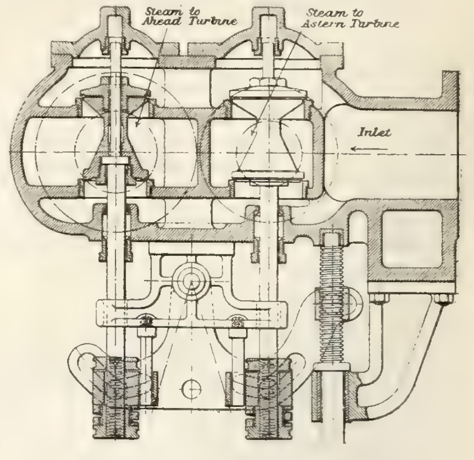


FIG. 9.

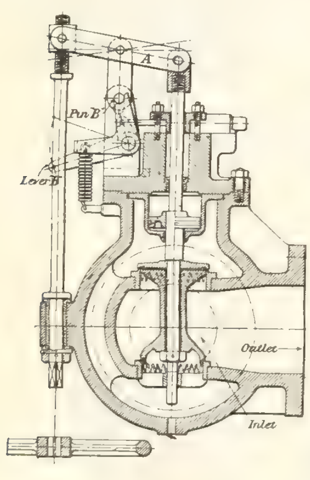
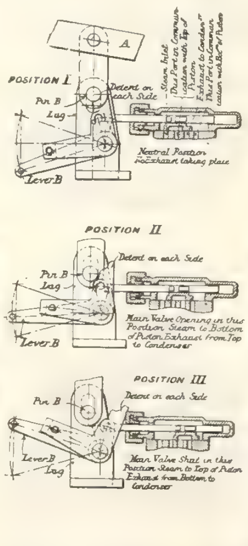


FIG. 7.



FIGS. 7a, 7b, 7c.

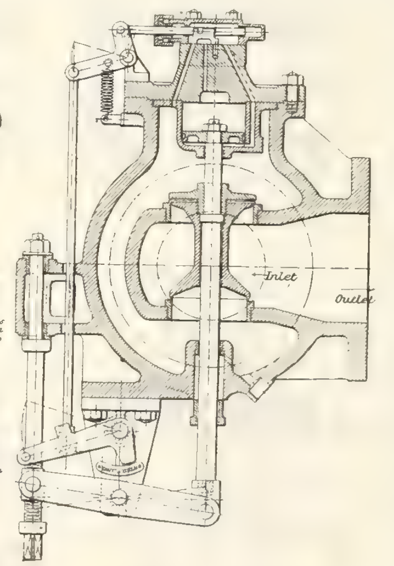


FIG. 7d.

Balanced Valves

In singlebeat valves of sizes over 4 in. and pressures in the region of 180 lb. and above, the valves are difficult to operate unless large diameter handwheels are fitted or handwheel spanners used to give the same effect or gearing introduced. The difficulty is due to frictional resistance in the screw and not to the direct load which, but for that resistance, would allow for quite a reasonably sized handwheel and comparatively quick-pitched thread in valves up to about 12 in. diameter. For regulating purposes large diameter handwheels or gearing are objectionable, not enabling the valve to be handled as expeditiously as is desirable. A compromise for this type of valve is effected and is shown in Fig. 6. A pilot valve is introduced and lifts first, balancing to a certain point the pressure in inlet and outlet branches. The main valve is then lifted against much less load. This fitting is extensively adopted, but occasionally trouble is experienced from the main valve pulsating or clattering, in reciprocating machinery, due to the fluctuating flow of steam—which causes damage to the internal parts.

Solid double-beat valves got over this trouble in the majority of cases and were perfectly balanced to all practical purposes, but they had one outstanding defect—they were rarely, if ever, steam-tight, which was very unsatisfactory. For reciprocating work this did not affect the steam consumption to any extent, as it was only when the machinery was at a standstill that leakage was occurring, and if a stoppage was of any length of time the boiler stop valves could be shut down. For turbine machinery, however, leaky astern valves can very seriously affect the economy. The leakage in the solid double-beat stop valve was due to differences of expansion between the double-beat valve and the seatings in the chest and could not be got over. A solution of the difficulty was ultimately found in introducing a flexible disc to one of the beats, and the names associated with this introduction were also Messrs. Bevis, Gibson, and Cockburns, Limited. This valve has been very extensively adopted in varying designs and is exclusively used for all regulating valves in His Majesty's Navy.

Double Beat Valve for Reciprocating Work

Fig. 7 shows a double-beat type of valve used for reciprocating work for regulating purposes and also as a throttle valve, doing away with the butterfly type. In this latter capacity a very light duty is thrown on any form of governing gear, while in larger sizes it obviates the necessity for employing a separate throttle engine, say of the Brown type. For ordinary opening and closing as a regulating valve the pin B is locked by the detents as shown, thus allowing the valve to be positively opened or closed. During these operations the control valve is in the neutral position, preventing steam from passing to the condenser. The operating piston has also inlet pressure on both sides of it, thus effecting a balance. The two beats of the valve have saw-formation spigots; this is to allow of close regulation, particularly where shafting is employed to bring the handwheel to a position not directly below the valve. The back-lash in this instance often allows a big jump to occur in the regulation, which is prevented with the design as shown. This jump is due to the following cause:—

With a valve of this design, that is, with steam entering outside the beats and the spindle going through the cover, there is in the first instance a closing effort due to the pressure on the increase in area of the top beat. The pressure on the area of the spindle where it passes through the stuffing-box is an opening effort. Generallv the ratio of the former area to the latter is as two to one, with the result that when the valve is opened to an extent allowing half the initial pressure to be present in the outlet the efforts balance each other. A pound or two over this and an opening effort is present, with the result that the valve jumps open whatever play there is in the operating gear. With the saw formation of spigots this jump does not affect the revolutions to any extent. If instead of the spindle coming through the top of the cover it had come through the bottom of the chest the effort would have been a constant closing one, and there would be no necessity for the provision of the saw formation of spigot. Further on, valves with their spindles coming through the bottom of the chest are shown in Fig. 7d, 8, 9 and 10. The saw formation of spigots is a refinement to give close regulation from dead slow to full speed, as many doublebeat valves are made without this formation. When the valve is opened to any degree of regulation it can be shut and opened again by the throttle gear in following manners: In Figs. 7a, b, and c, the throttle lever B is moved from position 7a to 7c. The control valve during this operation moves through position 7b, holding the main valve open till the detents have cleared themselves from the pin B, then with the throttle lever in position 7c the main valve closes—the levers swinging from the nut on the regulating screw. To open up again the lever B is returned to position 7a, the main valve opens up and the small tension spring returns the detent, again locking pin B and putting the valve into a position of positive control. This fitting has given general satisfaction and has been extensively adopted.

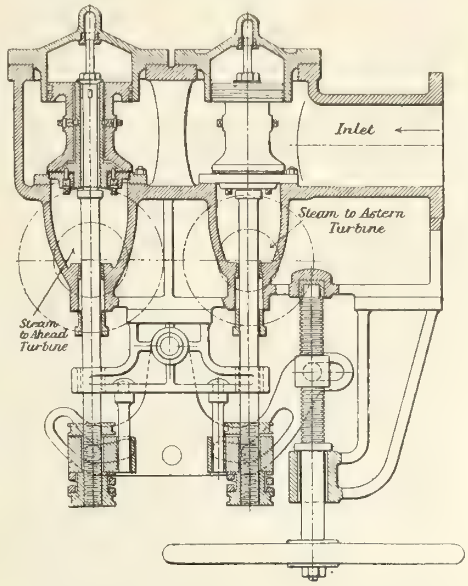


FIG. 10.

In future it is intended to make the last type of valve as modified and shown in Fig. 7d. A constant closing effort is present, which will allow of perfect regulation under all circumstances and will not necessitate the adoption of saw-formation spigots on the beats. The action under throttling conditions is similar to the former valve, with the difference that the slide valve is returned from position 7c to position 7b and 7a by the spring, assisted by the inlet pressure on the area of the slide-valve spindle where it passes through its stuffing-box.

Hardening-down stresses are alleviated by the expansion of the spindle under temperature. The illustration also shows the relative positions of ports and passages, and consequently gives a better idea of the connection between the positions of the controlling slide valve and the positions of the main valve than is shown in Fig.7.

To prevent water coming down between the spindle and stuffing-box of the main valve, as far as possible, the stuffing-box is kept high in the inside of the chest, and a drain-hole provided at the top of the packing to drain any water that may tend to accumulate there to the bottom of the chest. Provision is also made for taking away any drips that may come down.

In both the foregoing valves the design has been devised from the point of view that the relative positions of the indexes for both main and throttle valves at the starting platform are exactly similar to those where separate valves are fitted. A point of particular importance has also been carefully observed in the design, namely, that wear and tear have no effect on the efficiency of the gear.

Regulating Valve for Turbines

Fig. 8, page 40, shows a type of ahead and astern doublebeat regulating valve for turbine machinery, of which a large number have been fitted. With this arrangement one handwheel only is necessary. In a mid position both valves are shut, rotation in one or other direction opens either valve, the shut valve meanwhile becoming the medium of the fulcrum for the opening valve. In a design of this sort it is essential that the handwheel should be most clearly marked by arrows for rotation for ahead and astern. Not only should the handwheel be marked, but an index should be fitted with a pointer of considerable travel indicating quickly which valve is being operated and in what direction. This also applies to single regulating valves because, while in the majority of cases valves are shut by what is termed a clockwise motion, that is right-hand when looking on the handwheel, with the valve or extending spindle receding from the same, there are cases of extended spindles where the motion is clockwise looking in the opposite direction.

With the arrangement as shown in in Fig. 8 it is possible, if the spindle of the open valve seizes in the neck bush or gland and it is desired to shut this valve and open the other one, that instead of shutting the open valve first the other valve is opened up—a most undesirable effect. To obviate this the design as shown in Fig. 9, has been adopted with most satisfactory results. Here the open valve must be positively shut to the point of the spigots entering the seats before the opposite valve can be opened. After this point the valve is closed and contact made with its seat by the pressure of steam on the difference of area of the two beats of the valve, plus the pressure into the area

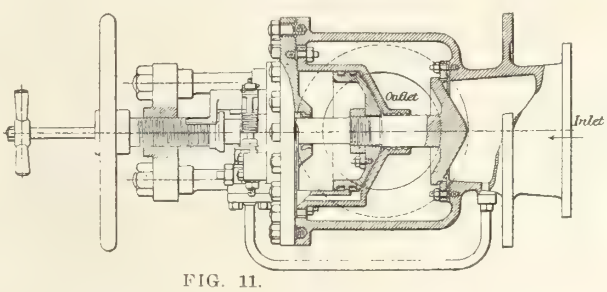


FIG. 11.

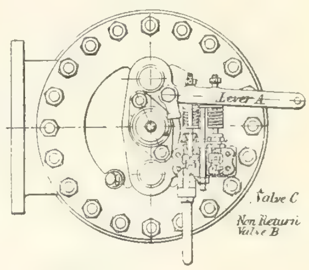


FIG. 11a.

of the valve spindle where it passes through the stuffing-box. The springs on the spindles also assist this effort. No greater closing effort can be put upon the valve. In this respect it differs from the fitting shown in Fig. 7, where, of course, the valve can be hardened on its seat to any extent.

Another arrangement of balanced valves which has a much greater final closing effort, and consequently ensures tighter valves, is shown in Fig. 10. The valves are balanced by the control valve, which forms part of the spindle, first exhausting steam from the top of the piston. Another outstanding feature is the simplicity of the chest casting, particularly desirable in cast steel. The closing effort when the valves are shut is the pressure on the area of the valves. In these designs of double manoeuvring valves and valve as shown in Fig. 7b it will be noticed there are no stresses due to expansion of spindles.

Valve for Turbine Service

A valve widely adopted in conjunction with turbine machinery for both naval and mercantile work is shown in Figs. 11 and 11a. This fitting is a combined bulkhead shut-off and emergency valve. It also fulfills the function of a self-closing valve in naval work. For ordinary opening and closing the valve is operated in the usual way by means of a handwheel. In the larger sizes it is necessary to employ a handwheel spanner. When the main valve commences to open the collar on it has an inclined plane action on the lever A which lifts the spindle of the non-return valve B, allowing steam to pass to the top of the piston and check any sudden opening tendency. The leakage past the piston rings determines the opening speed of the valve. For shutting by throttle or emergency gear, the lever A is moved further, which opens valve C; this exhausts steam from the under side of the piston, when the pressure on top of it closes the main valve. On returning the lever the main valve slowly opens up to its previous amount of lift. For naval work, where there are two or more bulkhead valves, if the pipe on the inlet side of one valve is shot away the valve is supposed to self-close with the reverse flow of steam. When this occurs the non-return valve B also closes. The efficiency of this fitting was lately demonstrated unintentionally in a fast ship of war. An exceptionally heavy sea broke over the vessel, the turbines stopped, and for some time no explanation was forthcoming; ultimately it was found that the sea had carried some gear against the deck emergency lever and moved it into the shut position, with the result that both bulkhead emergency valves were effectively shut.

CUNARD SHIPS IN U.S. YARDS

THE placing of contracts for merchant vessels by the Cunard Steamship Line has ben noted from time to time within the past few weeks. An official statement has now been issued by James McNaught, of Esplen Sons & McNaught Inc., naval architects, who have acted for the Cunard Co., in placing orders for boats with American shipyards: "Details of the Cunard shipbuilding cannot be given, as the Company is under the British censor, but I can say that the Cunard construction program is the greatest in the history of shipbuilding. Orders are being placed in almost every available yard. The Bethlehem Steel Co. is to build ships at the Maryland and Fore River yards and at the Union Iron Works. The Todd Shipyards Corporation has orders for six ships of 7,500 tons at the Seattle yard. The Sun Shipbuilding Co. also has orders."

"Ships to be built in the United States vary from 7,500 tons to 12,500 tons. Several steamers are being built for the Cunard Co. in England, and at least one will have turbo-electric propulsion. At present England has three or four ships under construction of that class. Trials of this power have been sufficient to justify installing this machinery on one of the big Cunarders. I cannot give the size of these vessels. One of the small steamers with the new power will be of 5,500 tons. They will all be capable of high speed."

S.S. "ALGONQUIN" SUB. VICTIM

THE American steamship Algonquin, with ten Americans aboard, was sunk by a German submarine about 6 a.m. on March 12 with a loss of vessel and cargo valued at $1,700,000. A cable message received by her owners, the American Star Line, and despatches from London told of the safety of all the officers and crew, twenty-seven of whom have been landed. The message to the owners said the vessel was torpedoed, but did not indicate where she was at the time. According to a Consular report from Plymouth, Enland, the Algonquin's captain stated his ship was attacked by shell fire without warning, and finally sunk by bombs placed on board by members of the submarine crew.

The Algonquin sailed from New York on Feb. 20 with foodstuffs worth $1,250,000. Her destination was London. She was one of the first American ships to leave the United States after Germany established her submarine blockade. Formerly a Canadian-owned boat under British registry, the Algonquin was transferred to the American flag last December when she was purchased by the American Star Line. While under Canadian ownership she was latterly engaged in trade between New York and St. John, N.B.

Before that, she was in the great lakes service, being owned by the St. Lawrence & Chicago Steam Navigation Co. She was a vessel of 1,806 tons gross, 245 feet long and 40 feet of beam, single screw, and was built at Glasgow in 1888. The Algonquin was a familiar visitor to Toronto harbor some years ago, having wintered here with her sister ship, the Rosedale.

"STORSTAD"-"EMPRESS OF IRELAND" COLLISION CLAIMS

IN the Admiralty Court, Montreal, on March 17, Mr. Justice Maclennan gave judgment in the Storstad case holding that the Maritime Law of England governs the rights of the parties in respect to the claims for damages suffered through the sinking of the Empress of Ireland in the Gulf of the St. Lawrence after collision with the coal steamer Storstad. This decision was reached in virtue of the proof that the Empress sank over three miles from our nearest coast-line, and thus beyond the jurisdiction of the Canadian Law.

The English law gives preference to payment of claims for loss of life in the wreck. The amount claimed under this head was $3,069,483. The total amount available for distribution is only $175,000—being the proceeds of the sale of the Storstad—so under the operation of the law of preference absolutely nothing is left to meet the claims for loss of property, including $2,500,000 for the loss of the Empress and her cargo.

It was when the Deputy-Registrar of the Admiralty Court, W. S. Walker, K.C., proposed to distribute the amount available pro rata in favor of the life claims so far as such funds were sufficient that the Canadian Pacific Railway Co., the Aetna Insurance and other companies appealed to Mr. Justice Maclennan and asked to have the distribution made on the basis of a pro rata division to all claimants, in accordance with the Canada Shipping Act, under which no preference or priority is given for loss of life.

Reasons for Judgment

Justice Maclennan, in rendering judgment, said: "The first important question to be decided is: Is it the Maritime Law or England or the Canadian Law which governs the rights of the parties in respect to the claims for damages and the distribution of the fund now in possession of the court? The Exchequer Court of Canada, as a Court of Admiralty, is a court having and exercising all the jurisdiction, powers and authority conferred by the Colonial Courts of Admiralty Act, 1880 (Imp.) over all matters within the jurisdiction of the Admiralty Division of the High Court in England. Although the Exchequer Court in Admiralty sits in Canada, it administers the Maritime Law of England.

"The collision in this case took place after the Empress of Ireland had discharged her pilot at Father Point. It is admitted the wreck now lies three and three-quarter miles from our nearest coastline, and the trial judge (the late Justice Dunlop) found the collision took place 1,200 or 1,500 feet east of where the wreck lies, which certainly was not any nearer the coast. The collision thus having taken place more than three marine miles from the Canadian coast, it must be held to have occurred outside the territorial jurisdiction of the Parliament of Canada, and on the high seas, as that term is understood in a British Court of Admiralty.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

FUSION OF OUR ROYAL AND MERCHANT NAVIES

By Capt. Geo. S. Laing.

THE sailor men and shipping of our vast Empire have at last come into the atmosphere of public confidence and appreciation. War has proved irrefutably that the fighting fleet and the commercial fleet are now interwoven beyond any possible disintegration. This is as it should be, and the wonder is, that the harmony of action wasn't cemented together long ago.

Geography of Empire

Our Empire's existence has a decided geographical side to it. The Motherland is in island formation, and her colonies are far-flung in the world. Australia needs ships and sailors for her protection and trade; Canada with her dual coast waters and her internal shipping routes is also in a similar position. Egypt and the Cape Colony end of giant Africa would be almost uninteresting without a constant stream of ships, and these comparisons apply to Newfoundland and India, Burmah, and so on, wherever a splash of red appears on the map.

The minute that the Kaiser set a lighted match to Europe, every sailor of the Royal and Merchant Fleets knew that a strong rope of interdependence would bring both fleets together. This rope, happily for our salvation, has been tarred with common sense and filial love to duty. The result of this floating brotherhood spells at the present moment immunity from invasion by sea, and almost uninterrupted trade on the waters of the globe. All the bloody piratical work that the Hun has perpetrated on the seas is, of course, far from the recognized rules of clean fighting. Take away their diabolical sailoring and they have no more than shaken their fist in their pocket yet.

Grimness of Naval Warfare

In every likelihood the North Sea will be the witness ground of a terrible naval battle before the ropes of peace are coiled up on the pinrail of righteousness, and huge fighting craft of both nations will carry thousands of brave seamen to pillow their maimed heads on Dogger-bank. Let it be remembered here that in sea fighting a cloud of hellishness attends the fray that makes it apparently more ghoulish than battles waged on terra-firma. Thousands of men are duty-bound to their respective places in the bowels of the great ship, and should defeat come a sickening lurch of the vessel as she heels over on the wounded side means a rat-trap death in which exploding boilers, moving machinery, and utter darkness add fearful horrors to the inevitable watery grave. Before Plimsoll's time, merchant vessels were sometimes termed "floating coffins" on account of their diminished freeboard, but in all seafaring men's breasts a desire to be drowned in the open has always been a paramount wish, whether from battle's cause or shipwreck, when the worst feature of their calling faced them.

In reflecting along such lines, is it not grand to contemplate that the sea life, whether for war or merchant purposes, has a magnetism of romance that can pull from the different parts of our Empire, full complements of brave men. The sea carried on its bosom our pioneer explorers, missionaries and colonists, and our supremacy as a nation at this moment was purchased on the waters. Father Ocean is nature's highway in trade and travel too, and nearly everything that you can associate with the British Empire has the salt water feature in its make up.

Prior to steam propulsion in vessels, every craft, whether smuggler, legitimate trade, or war-sloop, carried cannons, cutlasses and blunderbuss weapons to argue out any dispute with rival or hostile ships. In those days all seamen were more or less fighters, but when wooden walls and bellying sails were superseded by iron and steel leviathans with turbine engines, and long range guns, the double-purpose sailor disappeared, and ordinary merchantment ceased to be armed beyond small weapons for quelling mutiny. Thus it was that the two fleets drifted apart, but not far enough to obliterate their reciprocal interests, for we see them now fighting, working and sacrificing their lives in a joint purpose to purge the world of its evil spirits.

Merchant Seamen as Naval Ratings

Let us look at the naval defence that is in motion now, and we find merchant seamen of various grades in craft of all descriptions, from dreadnoughts and battle cruisers down to gun-boats and mine-sweepers. Before the war was a week old the Admiralty was calling for officers and men from the peaceful trading ships to man hospital ships, mine-sweepers, patrol boats, fuel craft, and other auxiliary craft so necessary in the work and manœuvres of the Grand Fleet. The all important service of transport ships with their human cargoes has also brought the merchant sailor into the mirror of public recognition, with the result that already a transfusion of brain and muscle from the one service into the other, has caused no less than King George himself and likewise his highest administrators to look upon the new state of things as a brilliant innovation.

Stagnation of sea-borne traffic for a few months would utterly paralyze our country, and no one knows it better than the Kaiser who has with his subaqueous maggots tried to terrify our merchant crews; but the Lusitania and the Fryatt instances of blind fury and inhuman ferociousness has only made the British sailors blood boil. The steam from that boiling will reach Berlin yet, and may scald William into wishing that he was set adrift on an Atlantic iceberg in his nightshirt.

Every soldier who has been carried over-seas to England, France or Greece has a warm spot in his heart for the sailormen who ply the Atlantic and Mediteranean, and it is very probable that a great number of those soldiers who return to Canada in good shape, will take to seafaring careers on our lake and coastal shipping. The caravan life of a sailor will appeal to those warriors who cannot again come to a state of rest on shore.

Motor Boat Patrol

The policing and reconnoitring that is carried on just now, mostly in British waters, but to some extent on colonial coasts too, is very little understood by the majority of shore folks. Take such branches of the naval service as the Motor-Boat Patrol. Here we have hundred of little fragile motor-boats, some of them fifty and sixty feet long, some of them much less, darting in and out of every cranny of the coast, throwing argus eyes out for enemy exploits. These tiny vessels are expected to wrestle with choppy broken water and in many cases go through a wave rather than over it. The discomfort of cramped quarters for the oilskinned crew and the lively motion of such a small craft is extremely hard on the men. Some of these boats are only hooded over.

Larger craft of this kind are decked over and have wireless outfits and guns for sniping subs; but, in this case also, the freeboard is very little, and, when stormy weather comes along, the decks are awash and even the officers in the tower or bridge are smothered in salt spray. So it is all along the big list of auxiliary craft that are so necessary to the great fighting ships. There are tow-boats, barges, steam and sail yachts, salvage and cable craft, colliers and trawlers, and many more, all doing their bit, and all manned and officered by Royal and merchant sailors. The sea as a profession has never been a carpet slipper job, and for that very reason we find the average "sea-dog" something of a limpet in determination. Glorious traditions of past sea fighting will be handed down and even eclipsed in this war.

Our Ensign Trio

Our three ensigns are all figuratively at the same peak halyards, the white bunting, the blue bunting and the red bunting, representing respectively the

Royal Navy, the Royal Naval Reserve and the peaceful merchantman. The Kaiser's wildest dream of expansion in floating status will never overwhelm the above trio in their heroic unification.

Something like four thousand non-combatants have been drowned and murdered under our merchant flag by the Hun policy. Two thousand of these victims were passengers, many were women and babies, whilst a thousand peaceful fishermen and a thousand peaceful merchantmen make up the list approximately. A fighting fleet that does a thing like that will never rule the seas.

For many reasons the press is not given much scope or encouragement in conjecture or fact along the naval side of our defence, hence the majority of folks hear little and understand less about the part that our brave sailors are playing in the great conflict that has already singed the wings and consciences of most civilized nations that have a division between right and wrong. Some deep thinkers believe that neutrality in its pure clothing has gone to the laundry. Such awful blots as the "Persia" sinking for instance will never wash out. Germany, Austria, and Turkey, all disclaimed this murder, and its a wonder that land-locked Switzerland didn't get the blame of it in the farcical controversies.

Our Floating Bulwark

After the naval brush in the North Sea, off Jutland, the people of the British Isles were not so prone when scanning their morning papers at the breakfast table to ask: "What is the Navy doing?" Where are they?" The Navy is doing all right, and would have probably done better if some of the highest statesmen had been jack-tars as well as politicians. Even so, the floating defence and aggressive position of our ships is a very live and formidable thing this day, and is becoming stronger each hour.

Some drastic reforms were necessary in the merchant branch of our shipping before the fusion of the twin navies could be kneaded with a surety of perfect confidence. In John Bull's easy going stride, it had long been the custom to allow foreigners to present themselves for Government certificates in merchant ships, and serve as mates and masters under the red ensign. The writer who has served twenty years in sail and steamships has served as a mate under both a Danish and a German Captain. Could you imagine a more unfair state of affairs than that? Yet, it has only been turned down since the war started. Of course it will never happen again, you need a pedigree of British authenticity as long as a tow-rope now to enter the quarter-deck.

Again look how we treated the German shipping in Australian ports and Indian ports. As honorable competitors, they were received like ambassadors; would that have happened if the evolution had been the other way about? Such companies as the P. & O.; the B. I., etc., who in some routes actually held a Royal charter for their trade development never raised a cry. In these various ways we practically hand-fed the sea-going Huns as we would tame pigeons on our lawns. No, they will never come back to such rosy beds in ocean service, and if the British seamen have any way in cementing up the cracks in the walls of future peace, ton for ton in commercial shipping will be exacted from the interned crafts of our enemy to make up for the wanton destruction of innocent and unarmed trading vessels.

Sea's Appeal to Youth

Sea service acknowledges its youthful members, and doesn't necessarily wait till grey hairs or bald pates are in evidence. Look at our young heroes, Flight sub-lieutenant Warneford, V.C., R.N., and Midshipman Drewry, V.C., R.N.R. These brave boys were both from the merchant service. The former has recently been killed in action, a short life, but what a magnificent record. Young men of this calibre are giants in action, and it would appear that the air and sea services, with their mysterious and unbridled element never fail to lure the adventurous flyer and sailor, away from a sure footing on terra-firma.

Dont misjudge the importance of the sailor men, from Admirals to powder-monkeys and mess stewards, from artificers to grimy firemen, who are bottomed down in iron holds. Have you seen these marine devils of stokehold coming off watch after a spurt of thirty miles an hour in a beam sea, with their paws blistered and their bulging eyes looking like poached eggs Perhaps you have not, but before long you may know more of their deeds. The spirit of our allegorical saint, Neptune, is calling for more men now.

PROPELLING MACHINERY FOR SHIPS—II.*

By W. J. Drummond

THE two chief rivals of mechanical gearing as a means of reducing the speed of the turbine to a suitable propeller speed are the Fottinger transformer and an electric drive. The Fottinger transformer has been developed in Germany by the engineer whose name it bears. Briefly it consists of a high-speed turbo-centrifugal pump and two water turbines designed to run in opposite directions and for a lower speed of rotation than that of the pump. These are all incorporated in one casing; the steam-turbine drives the pump, the water from which drives either water-turbine at will, both being rigidly connected to the propeller-shaft. Among the advantages claimed for this arrangement are the following: The astern power is a large percentage of the ahead power, sometimes as high as 90 per cent.; no power is wasted in windage of the astern turbines as in direct or geared turbine installations; warming up is simplified, for the turbine can be uncoupled from the propeller-shaft by not filling the transformer up with water; the transformer acts as an electric clutch between the propeller and the engine, so that if by any chance the former strikes wreckage, the shock is not transmitted to the engine; a smaller number of units is necessary for a given horse-power than with geared turbines.

*Read before the Institution of Mechanical Engineers—Graduates' Section.

Fottinger Transformer Efficiency

Against these advantages may be set the fact that the efficiency of transmission is low, for it only averages 90 per cent. as against $98\frac{1}{2}$ per cent. for the mechanical gearing; also, the limit for the ratio of reduction is only about 6:1, though it is claimed that, by introducing multiple stage pumps and turbines, a ratio of reduction as high as 30 : 1 could be obtained, associated with only a very small loss of overall efficiency. In connection with this type of reduction gear there are numerous ingenious details; one of these is the arrangement whereby the gear acts as a feed-heater, without any sacrifice of efficiency. An interesting combination has been fitted on board one of the German light cruisers; at high speeds the vessel is driven by two turbines of 20,000 h.p. each. These turbines have, at the high-pressure end, a Curtis wheel which exhausts into a Parsons drum, and operates the propellers through Fottinger transformers. On the port shaft, abaft the transformer, is a gear-wheel which is driven by means of a pinion on the end of a shaft of a 2,500 h.p. cruising turbine. This cruising turbine exhausts into the low-pressure end of the starboard turbine, and turns the port main turbine round in vacuo when the vessel is cruising. The maximum power the Vulcan Co. are willing to guarantee for the transformer is 30,000 h.p. per shaft.

Electric Drive

Turning now to the electric drive, this has its chief advocates in the United States, and so great is their faith in its efficiency and reliability that the California, a battleship, is to have electrical machinery. The decision to fit electrical reduction gear in the California was arrived at as a result of the success achieved with the fleet collier Jupiter. In this ship the machinery consists of one 9-stage Curtis turbine driving a 2-pole, 3-phase generator, generating current at 2,200 volts; the propellers are each driven by one 36-pole 3-phase induction motor, so that the ratio of reduction is 18 : 1. The revolutions of the propellers are 110, speed of vessel 14 knots, s.h.p. 7150; at full speed the steam consumption is 11.2 lbs. per s.h.p. per hour.

In connection with both the electrical drive and geared turbines, it may be noted that the United States Navy Department built three colliers identical in all respects, with the exception of the actual driving machinery. For the

driving machinery they fitted an electrical drive in the Jupiter, geared turbines in the Neptune, and reciprocating engines in the Cyclops. The geared turbines in the Neptune were fitted with a pneumatic bridge control whereby the turbines were placed under the direct control of the navigating officer; it is contended that this gives much greater rapidity of manoeuvring than with the usual system of engine-room telegraphs. The results of the numerous trials were not decisive in pointing to any one system as being superior to the other two, and the Navy Department has since built, or is building, three battleships each fitted with one of the types of machinery tried on board the colliers.

Among the difficulties encountered with such large electrical installations on board ship may be mentioned that of insulation, particularly when water finds its way into the engine-room. The increased complication and danger from faulty insulation are the chief objections to the electrical equipment as at present proposed. Of course, it is not necessary to use steam turbines as the prime movers, and suggestions have been put forward in which the engine-room is to approximate very closely to Diesel power-stations on land, just as many engines being kept running as are necessary to supply current to the main propelling motors. The chief field in which the electrical reduction gear would be useful appears to lie in the direction of vessels equipped with a considerable amount of machinery other than the propelling machinery—dredges of various types, and fleet colliers.

Engine and Boiler Room Auxiliaries

It is largely upon the efficient and regular working of the auxiliaries that the main engines are dependent for the good results obtained. It is not easy to single out any one auxiliary for special mention, but of recent years perhaps more attention has been paid to the air-pump and condenser than to any other. To such a high pitch have these auxiliaries been brought that vacua of within ¾ inch of the barometric height are usual on board turbine vessels. On board reciprocating engined ships such high vacua are not usual, or so necessary from the point of view of economy, for to attempt to make adequate use of such high vacuum the low-pressure cylinders would have to be excessively large.

Boiler Installation

Boilers on board ship fall into two main divisions—ordinary cylindrical or Scotch boilers, and the numerous types of water-tube boilers; with very few exceptions the distinction is that between mercantile and naval practice. The Scotch boiler, double or single ended, holds its own on merchant ships on account of its cheapness of construction and upkeep, simplicity, reliability, and economy in the hands of comparatively unskilled firemen.

From the naval point of view, the cylindrical boiler is too heavy, takes up too much room, is not sufficiently adaptable to the rapid variations demanded in the supply of steam, and takes too long to raise steam. With water-tube boilers on turbine-driven destroyers, the time of getting under way, starting from a cold ship, is that necessary to warm the turbines thoroughly, and has been known to be as little as twenty minutes. A few merchant ships are fitted with the Howden system of forced draught, but by far the greater number rely entirely on natural draught; in the Howden system a casing fitted on the front of the boilers is kept supplied with air at a pressure of 2 to 3 inches of water, the air is heated by the funnel gases, and then introduced into the furnace through suitable openings. The arrangement for forced draught fitted on warships is more elaborate, and consists in making the whole stokehold airtight, and keeping it under a pressure of 1½ inch of water in a battleship, to as high as 6 inches in a destroyer, when running at full speed.

The use of oil fuel on shipboard is limited to warships almost exclusively, in spite of its obvious advantages from an engineering point of view, among which may be mentioned ease of stowage, ease of embarking, high calorific value, wide range of power available at short notice, and the ability to force a vessel as long as the fuel lasts, for the fires do not get choked nor the firemen tired. A recent oil-burning destroyer could be run up from 5 to 25 knots in two minutes without any previous warning being given to the engine room. The large coal-burning warships are all fitted to burn oil as well, and carry a certain amount of it, up to 1,000 tons. This is to enable them to maintain a high speed for a long time if ever it should be necessary to do so. The only objection to the general use of oil fuel are the high cost and limited supply.

HEROES OF THE MERCHANT SERVICE

A LONDON contemporary has a note to the effect that with the advent of submarine warfare the merchant service reached the point of heroism. Not all the ruthlessness of the German underwater boats has ever prevented a single British crew from signing on, or a single British ship's officer from putting to sea. Indeed, the London newspaper concludes, several of these officers have already been torpedoed, and still they keep to their vocation, "open-eyed and unafraid."

The records of any shipping firm almost in the country might be brought forward to illustrate the truth of the assertion, but the history of a well-known local steamship line affords admirable proof. Several officers of the Clan Line have been torpedoed twice. Mr. Wooldridge, now chief officer of the Clan Maclean, suffered that experience in the Clan Grant and then in the Clan Macleod, and still lives.

Others, unhappily, have not been so fortunate. Mr. Hyslop, second engineer of the Clan Macleod, was torpedoed in that vessel, but lost his life when the Clan Leslie was sunk by a submarine some time afterwards. The same fate befell Mr. Macintyre, who survived the disaster to the Clan Macleod only to fail a victim when the Clan Macfarlane went under. Mr. Stanley, second officer of the Clan Grant, was torpedoed in that steamer, joined a prize vessel immediately, then went O.H.M.S. and was killed in action. Captain W. P. Smith, of the Clan Lamont, was chief officer of the Clan Campbell when that vessel was sunk by a submarine in the Mediterranean; and so on ad infinitum.

German frightfulness may seem very terrible to themselves, and it may be inexplicable to them why all our merchant seamen are not now skulking in the harbors, but, says a writer in "The Bulletin," there it is! The frightfulness that would drive a German sailor squealing for home has only this effect upon the British sailor—it calls forth a higher courage and arouses a more obstinate defiance.

SHIPOWNERS AND MARCONI WIRELESS TERMS

IT is hard to imagine that even in these days an international convention on safety of life at sea has been sitting, and is about to issue its recommendations. Its chief requirement—that ocean-going vessels must be provided with wireless telegraphy—had already been anticipated by the Board of Trade regulation issued last year under the Defence of the Realm Act. All British steamers of over 3,000 tons have to be equipped with wireless and carry a certificated operator. This is for the duration of the war.

In this matter, a situation has arisen which the shipping interests consider unfair. The Marconi Company insists upon a ten years' agreement, with a heavy penalty clause in the event of cancellation. The shipowners also pay $625 a year for the use of the apparatus and $500 for the operator, whilst at the same time they are bound to place the installation at the service of the Marconi Company for messages to and from passengers and allow the company 5 per cent. on all salvage rewards. On the other hand, the Government in some cases has offered to sell the wireless apparatus outright to the shipowners for about $2,500, and the latter are now contending that, as the installation is compulsory during the period of hostilities, this privilege should be extended. More will be heard on the matter, says the "Manchester Guardian."

Cleveland, Ohio.—The package steamer Mahoning has been sold to Boland & Cornelius, of Buffalo, by the Great Lakes Transit Corporation. The Mahoning is 274 feet keel, 40 feet beam, and 23 feet deep. It is understood the owners will cut her down to Welland Canal size, and operate her in the coal trade between Lake Erie ports and Montreal. Shippers are bidding $3 for tonnage in that trade. The Mahoning may be sent to the coast before the close of the coming season.

PROGRESS IN NEW EQUIPMENT

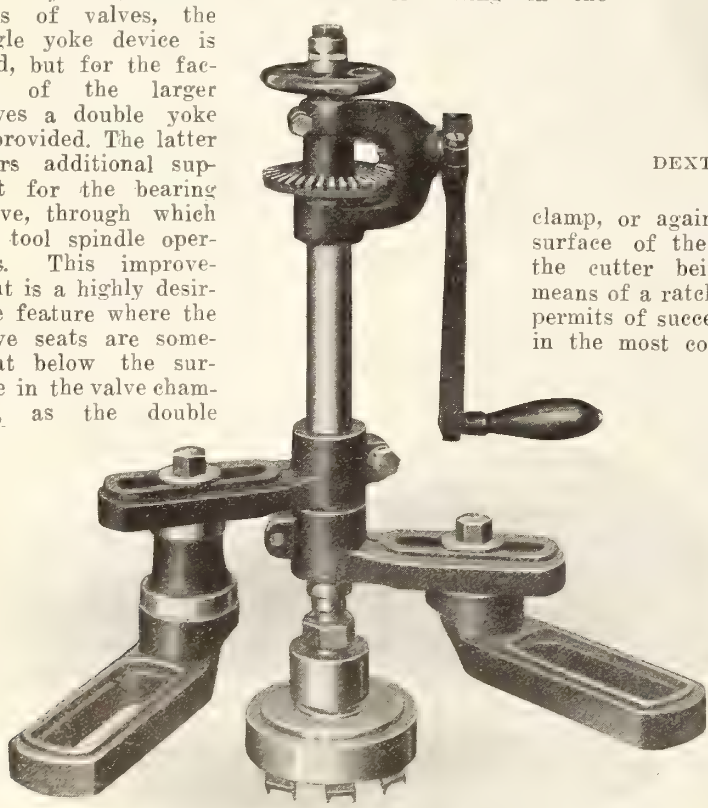
There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Axuiliary Product Achievement

PUMP VALVE RESEATING MACHINES

ONE of the chief factors in the maintenance of high efficiency pump operation is that of the care given the upkeep of the various valves forming part of each pump unit. The effect of wire drawing and the presence of grit in the water soon result in poor fitting valves; it is, therefore, essential that the accuracy of the latter and their seats be maintained. Where the failure of a pump to effectively perform its allotted task means the temporary shutdown of a portion of a plant, the question of prompt repairs is a very important feature.

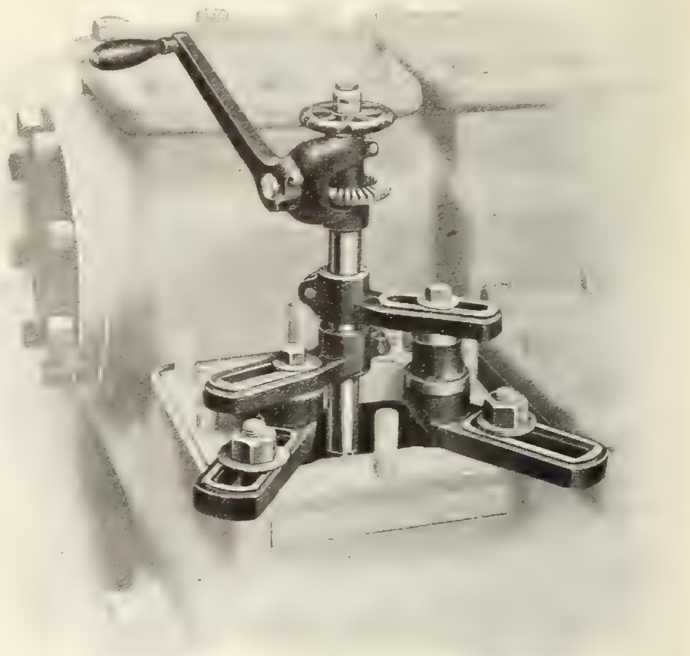
The accompanying cuts illustrate several applications of the Dexter pump valve reseating machines, and feature their usefulness in the repairing of various types of pumps now in service.

Simplicity of construction of this apparatus is coupled with high efficiency of action; a feature of their operation being the ease with which they are attached to any valve chamber. For the smaller sizes of valves, the single yoke device is used, but for the facing of the larger valves a double yoke is provided. The latter offers additional support for the bearing sleeve, through which the tool spindle operates. This improvement is a highly desirable feature where the valve seats are somewhat below the surface in the valve chamber, as the double clamping facilities offer increased rigidity when the machine is in service. For the smaller sizes, the cutter is driven direct by a handle attached to the spindle, and is operated in a direction parallel to the face of the cutter. In the large sizes, where more power is required, the cutter spindle is revolved by means of beveled gears working in a bracket secured to the upper end of the bearing sleeve; in this case the power handle operates at right angles to the cutter face.



DEXTER PUMP VALVE OUTFIT DH6.

Where the arrangement of the valves does not permit of using the long bearing sleeve, special devices are provided for the facing of the seats, the pressure being obtained by means of adjusting screws operating in the clamp, or against the opposite surface of the valve chamber; the cutter being revolved by means of a ratchet handle, which permits of successful application in the most confined locations. The types of cutters used on these attachments are made of best quality steel, and are otherwise designed to meet their special work. The action of the cutter leaves the surface of the seat perfectly smooth and free from chatter marks. Other designs of Dexter reseating tools meet the repair needs of valves on the high pressure hydraulic pumps installed in connection with shell forging plants.

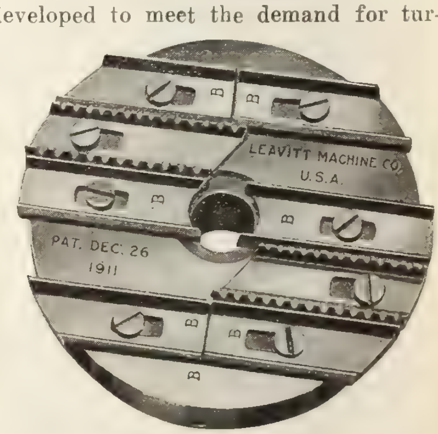


DEXTER DOUBLE YOKE PUMP VALVE RESEATING MACHINE REFACING SUCTION VALVE SEAT.

Darling Bros., Montreal, manufacture the foregoing products for Canadian distribution.

SINGLE AND MULTI-STAGE STEAM TURBINES

THE merits of the combination type of steam turbine have met with constantly increasing recognition during the past few years, and the turbine shown herewith has been developed to meet the demand for turbines of that type in sizes from 5 to 1000 horse-power.



DEXTER IMPROVED TYPE PUMP VALVE CUTTER.

The Moore steam turbine is built by the Moore Steam Turbine Corporation,

Wellsville, N.Y., in both single-stage and multi-stage designs, the former consisting of a single velocity stage made up of a set of diverging expanding nozzles and a wheel carrying two rows of moving blades, with a set of stationary reversing vanes following the first row of moving blades.

Figs. 1 and 2 are sectional drawings of the single and multi-stage turbines respectively from which it will be observed that the multi-stage turbine consists of the same single turbine, followed by two or more single pressure stages. Each of these single stages consists of a set of nozzles and a wheel. This form of turbine has given very efficient results in large size units, but has not hitherto been built in small sizes because of its rather high cost of construction. To overcome this difficulty, the Moore steam turbine has been so designed and standardized that the different parts can be produced on a quantity production basis; all standard parts are made for stock which enables rapid assembly and shipment of standard machines and also facilitates the supply of spare parts with consequent saving of time in repair.

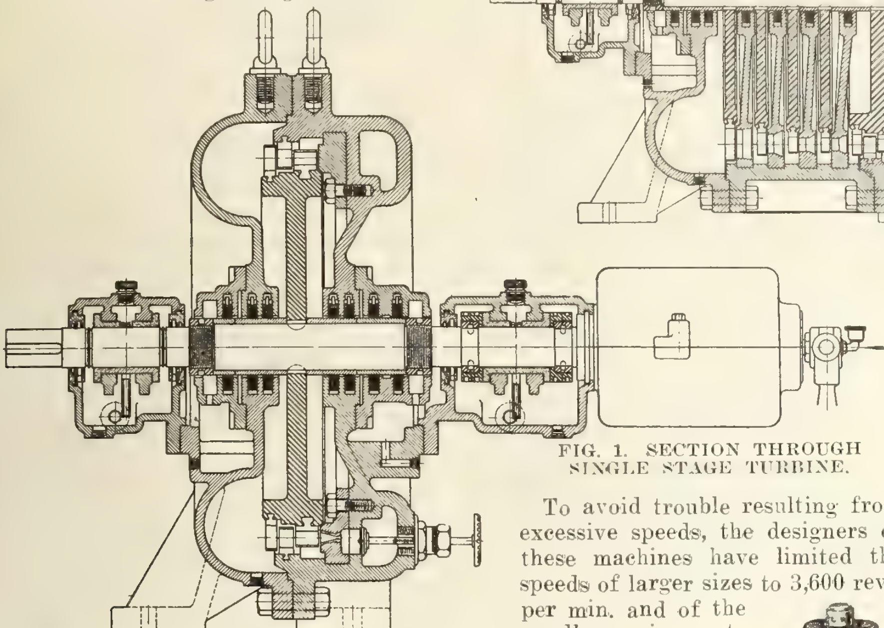


FIG. 1. SECTION THROUGH SINGLE STAGE TURBINE.

To avoid trouble resulting from excessive speeds, the designers of these machines have limited the speeds of larger sizes to 3,600 revs. per min. and of the smaller sizes to 5,000 revs. per min. as a maximum, the required steam consumption being obtained by multi-staging when necessary. By this means the rotation stresses are kept at a low figure with a larger margin of safety. A benefit obtained from the use of a velocity stage for the first stage is, that on account of the comparatively large drop in pressure in the first stage, there is less difficulty in packing the shaft against leakage at the high pressure end of the turbine.

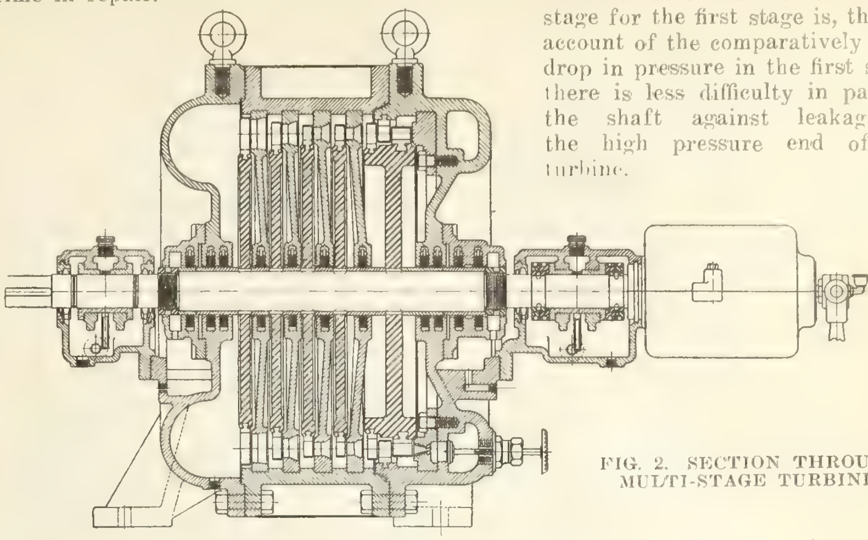


FIG. 2. SECTION THROUGH MULTI-STAGE TURBINE.

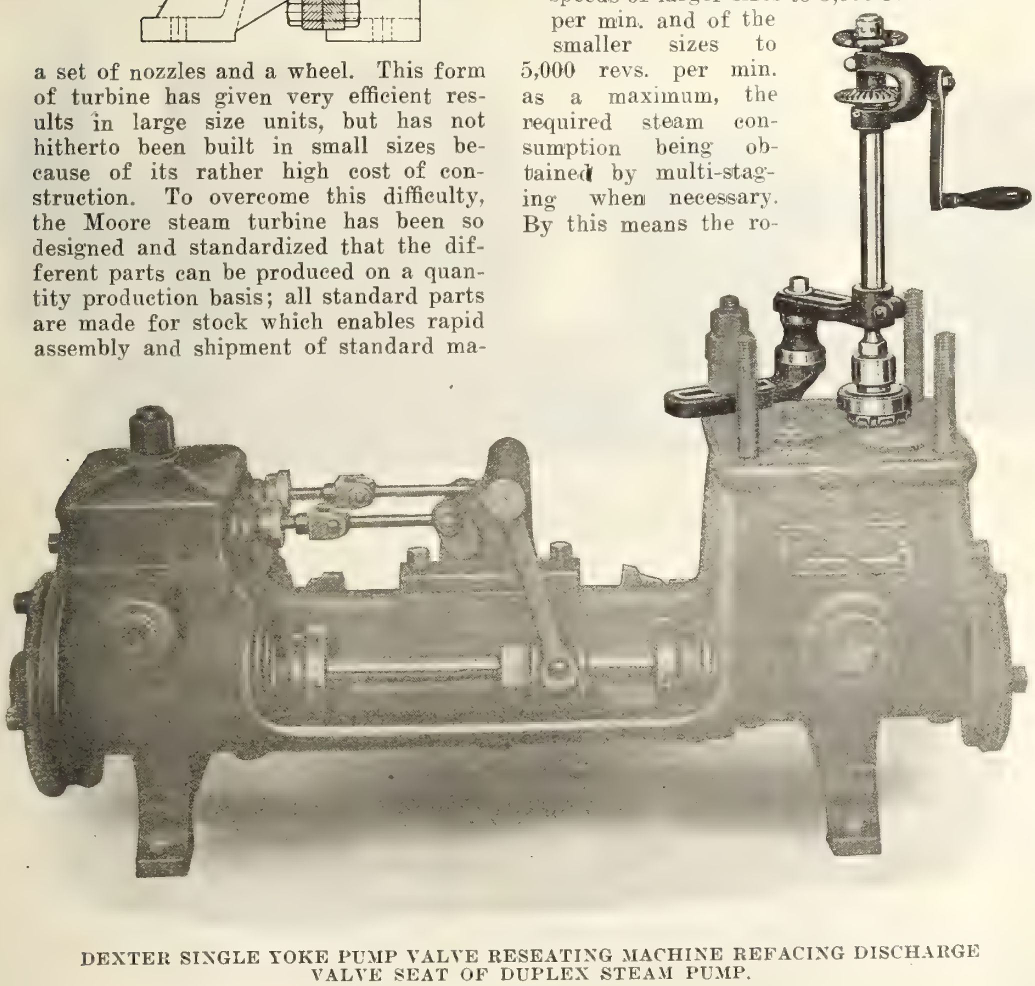
The turbine casings are in all instances split horizontally so that the upper half can be removed, exposing the rotor for inspection or removal. The diaphragms which carry the vanes are also divided horizontally, the two halves being attached permanently to the upper and lower halves of the casing and removed with them. Ample surfaces at the joints have been provided to prevent steam leakage, while the number of vertical joints has been reduced to a minimum.

The rotor consists of a single velocity stage wheel carrying two rows of moving buckets, followed by the pressure stage wheels, all mounted on the same shaft.

Drawn steel buckets are set into a dovetailed groove in the periphery of the wheel, being easily removed when renewal is necessary. Liberal clearance (½ in.) is allowed over the ends of the buckets, while the endwise clearance is so arranged that the side of the wheel and not the buckets will rub, should the rotor be displaced lengthwise. The nozzles in the first stage are of the diverging, expanding type, and are made of bronze, cast and finished accurately to size, and then recast into a cast iron ring, which is attached to the steam end casting. The nozzles of the second and following stages are formed by casting sheet metal strips into the diaphragms, being afterwards broached out to gauge to the size required; this method of manufacture gives a perfectly smooth and highly efficient nozzle.

Reversing vanes are used only between the two rows of moving buckets of the first stage wheel, being set into a bored dovetail groove in the steam end casting, and held securely in place by suitable attachments.

The bearings, which are of a suitable high speed type are fitted either with ring or forced



DEXTER SINGLE YOKE PUMP VALVE RESEATING MACHINE REFACING DISCHARGE VALVE SEAT OF DUPLEX STEAM PUMP.

lubrication, or both, depending on the size of turbine and operating conditions. Suitable thrust bearings are provided to maintain the rotor in its correct operating position. Where extremely close regulation is required, as in the case of generator units, an oil relay governor is fitted, a Jahns governor being used to actuate the oil relay control. For ordinary service, the governor is of the direct connected type mounted on the end of the turbine shaft and actuating a regulating valve of the double beat balanced poppet type. An overspeed governor is provided which is entirely independent of the main governor, and which, should the speed of the turbine exceed a certain predetermined amount, trips a valve in the main steam connection.

Non-condensing turbines in small sizes are usually of the single velocity stage type; and in larger sizes are of the three or five stage multi-stage type; condensing turbines up to 500 horsepower are built as five or seven stage machines. A larger number of stages is used for 500 to 1,000 horse-power machines.

GUIDANCE SPECIFICATION FOR TRIPLE-EXPANSION MARINE ENGINES FOR CARGO BOATS*

IN the present crisis of the country's history it is the duty of all of us to bethink ourselves and consider how we are to hold our own in the approaching contest for supremacy in the industrial world. As shipbuilders and engineers, it is specially incumbent on us to look forward to what is likely to happen after the war, and to prepare for the new conditions as far as we possibly can. Intensified and organized competition from abroad is the least that may be expected. As to whether this will be met or not depends on whether our manufacturers so bestir themselves as to procure not only vastly increased economy in production, but also increased efficiency of their products. Labor questions do not come within our present scope, and we therefore confine ourselves to the scientific and technical factors of the problem, the influence of which cannot well be over-rated. Old designs and easy-going or antiquated methods will be rigidly overhauled, and, where necessary, must be brought up to date under the guidance of the latest research and reliable experience.

Specification Basis

Animated by these views, the Council of the Institution, after grave consideration, have taken the first step in what they trust may develop into a beneficial and helpful enterprise, and hereunder present for discussion by the members the draft of the Guidance Specification for Reciprocating Triple-expansion Engines intended for moderate-speed cargo boats engaged in general trade. The specification is based on the best practice of the day and the district, and the object in view is the ultimate standardization of parts. There is no intention whatever to change accepted and successful practice, but merely to reduce that practice to a common basis, and to add to it when desirable or necessary, in order to raise performance to the highest pitch of efficiency. It is hoped that ultimately the specification will be extended to include not only the main engine proportions and scantlings, but also the boilers, auxiliaries, and other details. Quadruple-expansion geared turbines, as well as internal combustion engines, will also be dealt with as time permits.

The Council suggest that the present instalment, as and when approved by the members in general meeting, shall be known as "The North-East Coast Institution Guidance Specification (1917) for Cargo Boat Triple-expansion Engines." It is hoped that it will be accepted by marine engine builders, and that it may prove beneficial, not only in securing maximum rate of progress in technical advance, but also in promoting convenience and despatch in the purely business sphere. The Council propose that discussion in the meantime be restricted to the subject matter of the present draft, and that an annual revision be made in order that the specification may be kept thoroughly up to date, and may command the confidence and promote the ultimate interests of all concerned.

Specification Detail

1—Indicated Horse Power.—For calculation purposes in this specification and in average sea conditions the I.H.P. is to be found as follows:—

$$\text{I.H.P.} = \frac{D^2 S N}{700}$$

D=diameter L.P. cylinder in inches.
S=stroke in feet.
N=revolutions per minute. Found as per Section (2).

The divisor is adjusted for a referred mean pressure of 30 lb. per square inch.

2—Revolutions. $N = \frac{32\,(S+4)}{S}$

3—Boiler Pressure.—180 lbs. per square inch (gauge).

4—Ratios of Cylinder Areas—Ratio for 180 lb. pressure:—

H.P.	M.P.	L.P.
1	About 2.74	About 7.5
	1	" " 2.74

5—Cuts Off at Sea Power:—

Per cent.	Per cent.	Per cent.
About 57.5	57.5	55

6—Speeds of Steam.—The mean steam speeds to be calculated as follows:—

$$\frac{\text{Area of cyl. in sq. in.} \times \text{piston speed in feet per sec.}}{\text{Area of pipe, port, or opening in sq. in.}} = \text{Speed in feet per sec.}$$

Table of mean steam speeds in feet per second:—

	H.P.	M.P.	L.P.
Main steam pipe ..	110	...	...
Port opening	110	150	240
Steam ports	80	85	100
Exhaust passage or pipe	60	65	75

Width of Steam Ports.—Width of ports to be about 0.8 of diameter of cylinder.

7—Maximum Load.—The maximum load on main working parts to be taken as the product of the area of H.P. cylinder in inches and the boiler pressure in pounds per sq. in. (gauge).

8.—Crank Shaft.—The diameter of crank shaft in body to be to nearest ⅛ in. above Lloyds Rule, and the proportions of the remaining parts to be not less than the following:—

(1)—Diameter of crank-pin to be equal to diameter of shaft.

(2)—Diameter of crank shaft in web

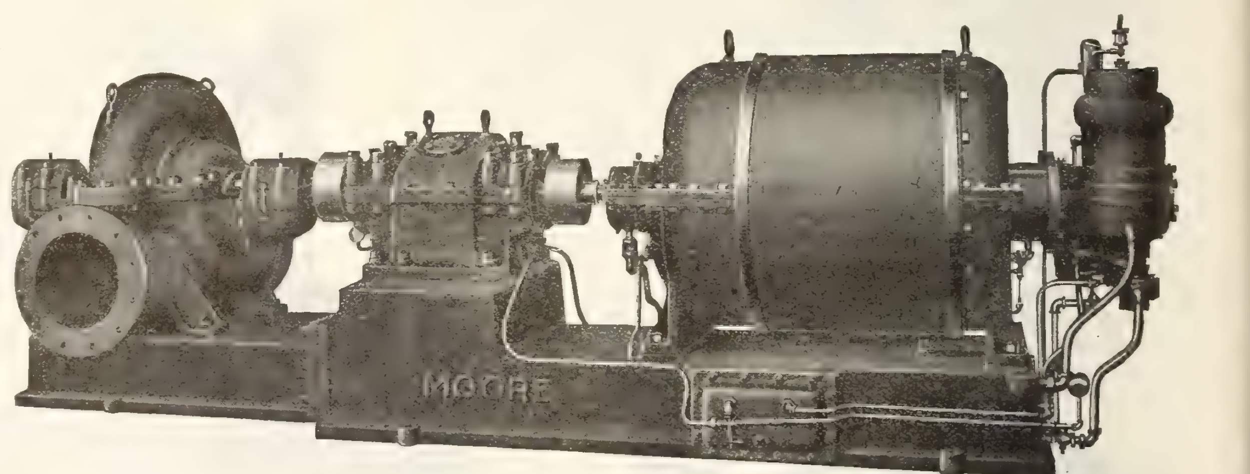


FIG. 3. MULTI-STAGE STEAM TURBINE DRIVING CENTRIFUGAL PUMP THROUGH DOUBLE HELICAL REDUCTION GEARS.

*Compiled by the Council and Members of the North-East Coast Institution of Engineers and Shipbuilders, 1917.

to be equal to diameter of shaft plus ½ in.

(3)—Diameter of webs to be equal to diameter of crank pin by 1.85.

(4)—Thickness of webs to be equal to diameter of shaft by .62.

(5)—Thickness of couplings to be equal to diameter of shaft by .25.

(6)—Six coupling bolts to be used for shafts up to and including 15 in. diameter. Nine coupling bolts to be used for shafts above 15 in. diameter.

(7)—Diameter of pitch circle of coupling bolts to be 1.43 diameter of crank shaft.

(8)—Diameter of coupling bolts to be equal to:—

$$.7 \times \sqrt{\frac{\text{dia. of shaft}^3 \text{ in inches}}{\text{number of bolts} \times \text{dia. pitch circle in inches}}}$$

Bolts to be parallel.

9.—Length of Connecting-rods. — Length of connecting-rod between centres to be twice the stroke or four times the crank radius.

Diameter of Connecting-rod. — Connecting-rods may be made parallel, same diameter as piston-rod body.

Connecting-rod Top Ends.—Connecting-rods to have single top end gudgeons for all engines having H.P. cylinders of 25 in. diameter and under.

10.—Crosshead Guides.—Main crosshead guides to be of the single type in all sizes of engine.

Load on Main Crosshead Guides. — Maximum load in pounds on crosshead guides to be taken as:—

$$\frac{\text{Area of H.P. cyl. in sq. in.} \times \text{boiler pressure in pounds per sq. in (gauge)}}{4}$$

11.—Maximum Pressures on Principal Bearing Surfaces:—

	Lbs. per sq. in.
Main bearings	250
Crank pins	500
Crosshead gudgeons	1000
Guide shoes (ahead)	55
Guide shoes (astern)	110

Diameter by length to be taken as area of bearings.

Overall length by overall breadth as area of guide shoes.

12.—Maximum Stresses on Principal Working Parts:—

	Lbs. per sq. in.
Ingot steel piston rod at screw	6000
Piston-rod body (after deducting ¼ in. from diameter to allow for returning)	3000
Piston and connecting-rod bolts at screw	5500
Main bearing bolts	4500
Main bearing keeps (if forged)	6000
Connecting-rod bottom end keep (if forged)	7500
Piston-rod keep (if forged)	7500

(The keeps are calculated as beams with distributed load and supported ends.)

13.—Valve Gear. — The valve gear sizes to be determined from the load on the M.P. slide valve spindle, calculated as follows:—

Load in pounds = .165 [54 (A-B) — 9 C.],

Where A = area of face of M.P. valve
B = combined area of steam ports in valve face in sq. in.
C = combined area of exhaust ports in valve face in sq. in.

Valve Spindles.—Diameter of valve spindles at gland to be not less than:—

$$\frac{\text{Diameter of piston-rod at gland}}{2} + \tfrac{5}{8} \text{ in.}$$

Maximum Pressures on Bearing Surfaces of Valve Gears:—

	Lbs. per sq. in.
Link block gudgeon	500
Link block slippers	300
Eccentric rod top end pins	500
Eccentric sheaves (ahead and astern)	85

14.—Thrust Block.—When of horseshoe type, the pressure on thrust collars not to exceed 70 lb. per square inch when calculated from indicated thrust, which is determined as follows:—

$$\text{Lbs. Indicated thrust} = \frac{\text{I.H.P.} \times 33{,}000}{\text{Pitch in feet} \times \text{revs. per min.}}$$

15.— Circulating Water.—The amount of circulating water supplied to be 40 times the feed, taking the latter at 15 lb. of steam per I.H.P. per hour.

16.—Main Engine-driven Reciprocating Circulating Pump (Double-acting).—To be proportioned to deliver the above quantity of water at a displacement efficiency of 80 per cent

17.—Maximum Speeds of Circulating Water.—The speeds of circulating water are to be calculated as follows:—

$$\frac{\text{8 area of bucket in sq. in.} \times \text{bucket speed in feet per sec.}}{\text{Area of passage in square inches}} = \text{Speed of water.}$$

Approximate Speeds in Feet per Second

	Feet per second.
Main injection	9.0
Passages in pump	5.0
Valve grids	6.0
Past lift of valves	9.5
Discharge pipe	7.5

18.—Air Pump.—Capacity of air pump not les than one-sixteenth of the capacity of L. P. cylinder.

19.—Main Engine-driven Feed Pumps. Capacity each engine-driven feed pump 1-700th of capacity of L P. cylinder.

20.—Pump Gear.— Load on pump gear to be calculated as follows:—Load in pounds = 25 (area of air pump bucket + area of circulating pump bucket) + 15 (area of both feed pump rams + area of both bilge pump rams). All in sq. in.

Maximum Pressures on Pump Gear Bearing Surfaces.

	Pounds per sq. in.
Pump link pins	400
Engine link pins	300
Pump lever centre gudgeon bearings	250

For cargo vesels of large tonnage it is recommended that the circulating and feed pumps be independently driven pumps.

21.—Utilisation of Heat in Exhaust Steam from Auxiliary Engines.—A source of very considerable economy in a marine installation being the complete absorption by the feed water of the heat in the exhaust steam from the various auxiliaries including the steering engine, electric light engine, and evaporator, such a vacuum should be carried in the main condenser as will enable this to be effected in all seas in which the vessel trades. A vacuum of 27in. maintained in the steam space of the condenser, the temperature of the sea being 70 deg. Fah. (barometer 30in.), has been found to meet these requirements on an average cargo boat.

22.—Cooling Surface.— In determining the amount of cooling surface per I. H. P. average at sea, provision should be made for the rapid initial degrading effect of oil and scale on the tube surfaces, and also for the permanent prejudicial effect on the condensing efficiency of the residuair in the condenser

23.—Air Extraction by Steam Jet.—When a steam jet is employed for the extraction of air, and a suitable design of condenser is adopted, the greatly increased efficiency of the condensing surface enables a higher temperature of feed to be obtained, and for a given vacuum the sizes of air pump and circulating pump, to be considerably reduced, thereby saving pumping power and total weight.

24.—Pressure Losses in Vacuum System.—It is important to minimise the loss in absolute pressure between the steam space in the condenser and the mean vacuum line as shown on the L. P. indicator diagram, and also the loss between the steam space in the condenser and the air pump suction pipe.

In good practice (a) the vacuum line should scale 12¼lb., per sq. in. below the atmospheric line when the vacuum in the steam space of the condenser is 27 in.; (b) the speed of steam over the condensing surface should be such that the total resistance through the condenser does not exceed one-tenth of an inch of mercury or 1.36 in. of water, as measured by a resistance gauge.

25.—Prevention of Delivery of Oil to Boilers.—It is desirable that the oil should be separated from the auxiliary exhaust steam before it is used to heat the feed-water, but in any case the feed-water must be passed through a satisfactory filter before delivery to boilers.

26.—De-aeration of Feed-water.—Means should be provided for the deaeration of feed-water before it enters the boiler, with the object of preventing corrosion.

27.—Prevention of Heat Loss by Lagging.—Heat loss by radiation from unprotected surfaces being a very appreciable factor in the ultimate economy of a steam installation, the lagging of boilers, steam pipes, cylinders, auxiliary exhaust pipes, and feed pipes should receive expert attention in order to promote efficiency by means of an adequate thickness of non-conducting material applied in a workmanlike manner.

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Vol. VII MARCH, 1917 No. 3

PRINCIPAL CONTENTS

ACTIVITIES OF IMPERIAL MUNITIONS BOARD TO INCLUDE SHIPBUILDING

JUDGING from the continually expanding and variety-nature activities of what is known as the Imperial Munitions Board, with headquarters at Ottawa, it is quite apparent that not only was the establishment of such a body necessary and desirable, but its individual constituent has been such from a business administrative point of view as to earn the confidence and commendation alike of those whom it serves and the specific enterprise it directs. Its activities in munitions production, have, we make bold to say, had to be piloted into channels of effort little anticipated at its initiation, yet, notwithstanding that a number of quite gigantic undertakings relative to increased shell output have been little more than started, we find the Board's attention being given to the no less urgent call for ships, and preliminary steps being taken whereby Canadian shipbuilding and marine engineering enterprise will find the very widest scope outlet.

It is officially confirmed, we understand, that the Imperial Munitions Board, with whom negotiations have been in progress for some time past by the executive authorities in Britain, are developing an extensive shipbuilding programme to be filled in Canada, the individual details of which will not only tax the capacity of our already equipped plants, but will necessitate their extension, and the creation of further similar establishments. It is well-known, of course, that there exists meantime a very abnormal dearth of shipping—freight or tramp vessels in particular, and that while Germany's submarine activity—curtailed though it be to a great extent, continues, a lessening total tonnage available may be expected.

Notwithstanding the resumption of shipbuilding in Great Britain on a quite generous scale, our losses, both in ships and tonnage, have been enormous; the latter circumstance, however, but serves to demonstrate the fact of our being able to stand the losses, and yet prevail as overseas carriers. There is, nevertheless, a limit to which everything can be strained, individual or national, there is, therefore, wisdom in foreseeing the breaking point well in advance of the latter being reached. At a stage well removed from any real crippling of Britain's merchant fleet, a plan of campaign has been launched, to participate in which—as in men, munitions and money, Canada is invited. James J. Esplen, representative of Britain's Controller of Shipping, is co-operating with the Imperial Munitions Board relative to the placing of vessel contracts and their machinery—propelling and otherwise, while at the same time completing negotiations for the transfer of steel vessels building in Canadian shipyards to foreign order. Progress, we understand, can be reported in both directions.

In recent weeks, not a few corporations have been organized for the specific purpose of constructing steel ships, ranging all the way from 80-footers up to vessels of 7,000 tons, the plant locations covering the coasts of British Columbia, New Brunswick and Nova Scotia. That all of them will find the necessary capital and excellent opportunity for reasonable returns from its investment, may readily be taken for granted. The benefits derivable from the establishment and development of shipbuilding and marine engineering in Canada, of a scope and extent hitherto unknown, have been dealt with in these columns on several occasions, recent and otherwise. The myriad crafts and callings incidental and accessory to each primary enterprise have also been featured. The "way out" from a business depression immediately following the cessation of hostilities is being brought under our observation, in which connection it may not be inadvisable to indicate that there is here a field of productive effort for many of our small engineering concerns now engaged wholly on munitions production. Shipbuilding and marine engineering as exemplified in the finished product — either the combination passenger and freight vessel, or the "tramp," creates opportunity for the manufacture of ship deck machinery, consisting of winches, capstans, windlasses, steering engines, steering gear (hand), etc.; also engine room auxiliaries, which include, pumps, air, feed and circulating; dynamo-engines or ship lighting sets, stop valves, throttle valves, safety valves, sea chests, condensers, piping, lubricators, ash hoists, forced draught and ventilating fans, refrigerating machinery, etc. These, to name but a few of the more prominent accessories of a well-found ship, will serve to indicate a variety of direction in which metal-working plant effort meantime being devoted to shell production may find a waiting opportunity to be taken advantage of.

MARINE NEWS FROM EVERY SOURCE

Sarnia, Ont.—Capt. J. Reid has purchased the outfit cruiser Reo and will use her in connection with the Reid wrecking tugs this season. The boat is 50 feet in length and fitted for long trips.

Halifax, N.S.—During the past month applications were received at the Board of Trade office from two different parties for information regarding steel shipbuilding and the sites available.

Quebec, Que.—The manager of one of the leading ship-building companies of Lauzon has returned recently from New York, with a contract for the construction of fifty wooden vessels of the same style as those built last year only somewhat heavier.

Victoria, S.C.- The Norwegian steamer Strinda, Capt. Lovedahl, after undergoing extensive repairs and overhaul at Yarrows, Ltd., has left for Vancouver. The steamer, which is under charter to the C.P.R., loaded a capacity cargo for Vladivostok.

St. John, N.B.—It is reported here that a plan to establish a steel shipbuilding plant on the Miramichi River in Northern New Brunswick is being worked out. Two million dollars is said to be the capitalization. Montreal money is understood to be in the deal.

London, Ont. — Work will be undertaken very shortly, according to report, on the new $130,000 Government pier at Port Stanley, to be constructed at the request of owners of the fishing fleet at the port and of the London and Port Stanley Railway Commission.

Toronto, Ont.—Tenders will be received up to April 2, addressed to the chairman of Toronto Harbor Commissioners, 50 Bay street, Toronto, for the construction of harbor head walls. All information may be obtained by applying to the above address. E. L. Cousins, chief engineer and manager.

Toronto, Ont.—Tenders will be received for a building until April 9, addressed to the Toronto Harbor Commissioners, 50 Bay Street, Toronto, Ont. All information may be obtained by applying to the Architects, Chapman and McGiffin, 95 King Street East, Toronto.

The National Shipbuilding Co., has been incorporated at Ottawa with a capital of $100,000 to carry on the business of iron founders, millwrights, machinists and shipbuilders at Goderich, Ont. The incorporators are W. H. Hutchinson of St. Catharines, Ont., Robert G. Stewart and Ernest A. Larmouth both of Ottawa, Ont.

Victoria, B.C.—According to an announcement made by Captain C. H. Nicholson, manager of the G. T. P. coast steamship service, important structural alterations have been ordered for the steamer Prince John which is at present repairing at the Wallace Shipyards, North Vancouver, after her stranding in Wrangel Narrows a few weeks ago.

Japs Building Ships.—It is reported that a Japanese shipbuilding firm building stock boats on speculation has sold seventeen of them to British owners for delivery within the next six months. The tonnage involved is stated at 159,000 tons dead weight, the transaction being completed at a rate of about $215 a ton or more than $30,000,000 in the aggregate.

The Spirit That Wins.—A Cumnock, Ayrshire, Scotland, member of the H.L.I. tells a good story of the torpedoing of the Ivernia in the Mediterranean on the morning of New Year's Day. While he was in one of the small boats, which were launched with difficulty in a wild sea, he saw a man in the water clinging to an oar and singing "A Guid New Year to ane an' a'!"

Engineers and Office Help Released.—It is learned that the Department of Railways and Canals is releasing all engineers and office help engaged on the new Welland Ship Canal construction, work on which was discontinued some time ago. It is understood that the order covers the Chief Engineer as well as the subordinates, and that all will be relieved from duty by the 1st of April.

Victoria, B.C.—The C.P.R. steamer Princess Patricia, which is undergoing repairs at the plant of the Victoria Machinery Depot following her recent mishap by stranding on the Spanish Banks while on her regular run between Nanaimo and Vancouver, is expected to be ready to take the water very shortly. The work on the Patricia has proved to be bigger than was anticipated.

Victoria, B. C.,—In addition to the two car barges which are about to be built for the C. P. R. the contracts for which are expected to be let in the course of the present month, Capt. J. W. Troup, manager of the B. C. Coast service, announces that the company intends to call for immediate tenders for the construction of a 1200-ton capacity freight barge which will be used for general freight purposes.

British Corporation Vessel Register.—A few months ago, in view of the rapid development of shipbuilding on the other side of the Atlantic, the Committee of Lloyd's Register decided to open a branch at New York and to strengthen their staff in the United States and Canada. Now, the British Corporation Registry, whose headquarters are at Glasgow, have entered into an agreement with the American Bureau of Shipping.

Victoria, B.C.—It has been announced by Capt. J. W. Troup, manager of the B. C. Coast Steamship Service, that Clarence Hoard, of this city, had been awarded the contract for the building of one of the C. P. R. car-barges, and that possibly Mr. Hoard, who is a well-known contractor, would also secure the contract for the second barge which the C. P. R. decided recently to have built here. Each of the barges will have a capacity for holding nine cars.

St. Lawrence Canal Project.—Welland Board of Trade has passed a resolution, recommending that the Department of Railways and Canals begin at once the necessary plans and surveys for the building of a canal and river system from the foot of Lake Ontario to Montreal of a character and capacity to conform with the plans for the Welland Ship Canal, in order that the Department may be able to proceed with the work as soon as possible after the termination of the war.

Demand for Ships on Atlantic.—So great has been the demand for vessels on the Atlantic seaboard during the last year that 71 Great Lakes steamers, with a total tonnage of 683,770 tons, have been transferred to deep-water service. These vessels are now all operating out of Atlantic Coast ports, according to advices from the East. In Great Lakes shipyards there are at present 59 vessels building, which will be completed during 1917. It is believed that the majority of these craft will be sent to the Atlantic for service also.

Weather Man is King.—As a result of the narrow escape from disaster of H.M.S. Grilse, which was caught in a heavy storm between Bermuda and Halifax recently, the Dominion Government has taken one forward step towards the prevention of loss of life and vessels on the sea. No Government vessel is now allowed to leave port without consulting the Canadian Government weather charts, and if storm signals are posted or indications of heavy gales are men-

tioned, the vessel is absolutely prevented from leaving port.

Wireless on Lake Vessels.—Sixteen vessels which will ply the Great Lakes the coming season, will be added to the list of those carrying wireless apparatus. Contracts covering installation of wireless equipment on 25 additional vessels are now under consideration. When the season opens no fewer than seventy vessels will be equipped, to keep in touch with fifteen land stations of the Marconi Company, and with the U.S. Government station at Great Lakes, Illinois. A new Marconi Station being built at Alpena is expected to be in operation May 1.

Lake Boats Change Hands.—W. C. Richardson & Co. has added two more boats to its fleet, having purchased the steamer Frontenac and the barge Chattanooga from the Grand Island Steamship Co. The boats which have been operated by the Cleveland Cliffs Iron Co. have been turned over to the new owners. The Frontenac has a carrying capacity of about 3,200 tons and a keel length of 270 feet, a 40-foot beam, and is 24 feet deep. The Chattanooga is a wooden vessel with a 308-foot keel, 45-foot beam, and is about 4,000 tons gross.

Car Ferry "Leonard" Docked.—With the assistance of the Canadian Government steamer Lady Grey and the Quebec and Levis ferry steamer Polaris, the car ferry Leonard was successfully docked at Point Levis for underwater overhaul. The work was superintended by George D. Davie, general manager of the Davie Shipbuilding & Repairing Co., and Captain knowlton, marine superintendent. At this season of the year, on account of ice conditions and snowstorms, it was believed that the docking could not be accomplished. The success was therefore something in the nature of a triumph.

Vancouver, B.C.—Contracts have been let by the Dominion Government for the construction of two auxiliary schooners promised some time ago. The vessels, which will be used in the trade between Victoria, Vancouver and Halifax, via the West Indies, will cost approximately $250,000 each and the contract stipulates they must be ready for commission by September next. The vessels will be on similar lines to those now under construction for the Brown syndicate. The Wallace Shipbuilding yards at North Vancouver will build one of the vessels and the Cameron-Genoa Shipbuilders, Ltd., at Victoria, the other .

Cunard Line on Pacific.—Sir William Mackenzie is authority for the statement that the contract which the C.N.R. made with the Cunard Steamship Co. for the taking over and operating of the former company's Atlantic service contemplates the establishment of a service on the Pacific to be run in conjunction, with the company's land service. Under the contract made it is intended that a trans-Pacific service between Canada and the Orient shall be established. The Cunard Co., has just let contracts for ships to be built in Seattle yards, and these will, when ready, be placed on the Pacific route."

Further Recession in Shipping Risks.—Further recession has taken place in war risk insurance on Atlantic voyages. The rate is now as low as 6½ per cent., compared with 10 per cent. at the beginning of February. Some underwriters, however, are charging 8 per cent. The low rate is on liners and armed belligerent ships bound for the war zone.. Mediterranean rates continue at 10 to 12 per cent. and South American rates have held firm at from 5 to 8 per cent. The raider in the Indian Ocean is expected to cause an increase. Some New York underwriters quote war risk insurance contingent upon shipments within two weeks.

Montreal, Que.—It is expected that navigation will open about April 15. Officials of the Harbor Board predict that it will be considerably earlier this season than for some years past. April 15 is generally set as the date when the St. Lawrence channel will be sufficiently free from ice to permit of vessels coming into port. According to tests recently made, ice in the basin of the harbor is not more than four inches thick, and this is said to indicate that the break up is not very far distant. According to pilots there is no ice at all between Quebec and Grondines, and that the ice is comparatively smooth from the latter point up to Montreal.

S.S. "Storstad" Sunk.—The. Norwegian steamship Storstad, in the service of the American Commission for Relief in Belgium was sunk early in March by a German submarine in latitude 51.20, longitude 11.50 on the Atlantic off the southern coast of Ireland. The submarine fired about fifteen shots at a range of three to four miles. The Storstad stopped and hoisted the Belgian relief signal. The submarine submerged, but half an hour later the Storstad, which had not resumed her voyage, was torpedoed without warning as she lay stationary in the water, with all the crew on board. The latter, with the exception of the fourth engineer who died from exposure were rescued.

Lake Steamers for Ocean Trade.—Advices from Cleveland, Ohio, state that, according to the Shipping Act, American ships cannot be transferred to foreign registry without approval of the Shipping Board, but, if that can be secured, a number of lake steamers will be sold for salt water service before opening of navigation and will be placed under British registry. Options have been taken by unnamed Canadian interests on eight package freight steamers and, if the Shipping Board approves, sales may be closed at an early date, as the boats will have to be cut in two so as to pass through the Welland Canal. It is understood a good price has been offered for package freighters.

Will Build Cunarders at Portland.—Several steel freighters of 9,000 tons deadweight capacity will be built for the Cunard Steamship line at Portland, Ore. The contracts there will be divided between the Northwest Steel Co. and the Columbia River Shipbuilding Corporation, with probabilities that increased facilities will be provided. At present the Northwest Steel Co. is the holder of eight contracts for ships of 8,800 tons deadweight, and the Columbia River Shipbuilding Corporation has six of the same size, with at least two Cunarders. Three are well under way at the Northwest plant, and two of those building have been sold to the Cunard line, while at least two others that will be ready for delivery in the fall have been under negotiation, the four having originally been contracted by Lauritz Kloster, of Norway.

An Investment in Junk.—A United States steamship company purchased some vessels eighteen months ago at a cost of about $1,250,000. One of the lot had been in service for twenty years and it was planned to discard it as soon as possible and to replace it with a larger, up-to-date boat. This vessel was carried on the books of the purchaser at $80,000, but because of the shortage of ocean tonnage was put back into service to earn its keep . It has since turned into the owners profits amounting to more than $300,000, and has recently ben sold to another line for $750,000. It is not worth anything like that sum except under the extraordinary conditions which now prevail, but it will be put into the Atlantic trade carrying munitions, and if lucky enough to survive a few round trips will repay the new owners even at the exorbitant price paid. On this basis the earning possibilities of the tonnage tied up in New York harbor almost stagger the imagination.

S.S. "APPAM" RESTORED TO BRITISH OWNERS

BY a unanimous decision the Supreme Court of the United States, on March 6, decreed restoration to her British owners of the liner Appam and cargo, brought into Hampton Roads more than a year ago by a prize crew from the German raider Moewe. Ship and cargo valued at between three and four million dollars, must be delivered within thirty days, as the court's order is final.

The decision, written by Justice Day affirms decrees by Federal Judge Waddell, of Virginia, and upholds the original ruling by Secretary of State Lansing that prizes coming into American ports unaccompanied by captor warships have the right to remain only long enough to make themselves seaworthy. American neutrality was violated in bringing the Appam into Hampton Roads, the court says, and neither the ancient treaties relied upon by Lieut. Berg, the German prize commander, the Hague Conventions nor the Declaration of London, entitles any belligerent to make American ports a place for deposit of prizes as spoils of war under such circumstances.

"The principles of international law," the opinion adds, "leaving the treaty aside, will not permit the ports of the United States to be thus used by

the belligerents. If such use were permitted, it would constitute the ports of a neutral nation harbors of safety into which prizes might be safely brought and indefinitely kept. From the beginning of its history this country has been careful to maintain a neutral position between warring Governments and not to allow use of its ports in violation of the obligations of neutrality, nor to permit such use beyond the necessities arising from perils of the seas or the necessities of such vessels as to seaworthiness, provisions and supplies."

Justice Day in giving the court's ruling, recounted in detail how the Appam's crew and passengers were kept in subjection by bombs distributed about the ship and by threats to blow up the vessel if opposition were offered the German captors. He said the usual course would have been to take the vessel to a German port. "Instead, the vessel was brought over 3,000 miles to lay up in a neutral port. The principles of international law," he added, "would not permit United States ports to be used as places to lay up prizes."

"We think the views of the treaties taken by the Secretary of State are sound," he ruled, saying the court holds that the treaty applies only to prizes accompanied by a convoying warship. The jurisdiction of American courts also was upheld because, the court said, the United States courts must have the right to dispose of a prize which violates American neutrality. The decision was unanimous.

CANADA STEAMSHIP LINES ANNUAL

AT the annual meeting of the Canada Steamship Lines, which was held at the head office, Montreal, on March 7, W. E. Burke, assistant general manager, and F. S. Isard, general comptroller, were elected to the Board of Directors. The election of these two officials of the company to the board will fill the vacancies which resulted from the appointment of Sir H. Montagu Allan to the London board and the resignation of Aemilius Jarvis of Toronto.

J. W. Norcross, the vice-president and managing director, dwelt on the main features of the growth and development of the company's business, referring separately to the inland freight department, the passenger business and the ocean service. In speaking of the outlook Mr. Norcross said that, while he did not care to make any forecast of the possible earnings for 1917, he would state that up to the present time the earnings had entirely fulfilled expectations. He pointed out that the company's financial position at the moment is sound, and the physical condition of the company's property is excellent.

Mr. Burke's connection with the shipping business began in 1904, when he entered the service of the Richelieu & Ontario Navigation Co. A few years later he went with the Merchants Mutual Lines, of which Mr. J. W. Norcross was then President. In 1913, when the Merchants Mutual Lines, the Richelieu & Ontario Navigation Co., and other inland lake lines were amalgamated, with Mr. Norcross as managing director, the latter appointed his assistant to the post of assistant manager of the newly-formed Canada Steamship Lines.

F. S. Isard, the other new director, has been comptroller since 1913, when the Canada Steamships Lines took over the business of the Richelieu & Ontario Navigation Co. and other inland lake lines.

NOTES ON EXPORT PRACTICE

By Commerce

TO shippers who are only occasionally concerned with the export of goods, the fact that a ton is not always a ton is somewhat confusing. A ship of a definite net register tonnage may be charactered, a cargo of a certain gross weight in tons shipped on her, or freight paid at the rate of $30 per ton, yet in every one of the three cases the ton referred to is quite a different thing. Consider first the "freight" ton. In the earlier days of merchant shipping this really had reference to a ton of 2240 lbs., the ton being derived from the old English beer measure of a ton, same being 209 gals., or about 2,200 lbs. Owing to the fact that some materials are very much lighter than others, it was found necessary to charge freight on the cubic capacity of the goods with their cases, and, at the present time, the "ton" referred to in freight quotations means nothing more or less than forty cubic ft. The weight basis still remains for heavy or bulk cargoes, but, for all ordinary freight, it is necessary to measure up the outside dimensions of the boxes or crates, estimate the space they will occupy in the hold and to divide the result by forty.

Register Tonnages

A ship has two register tonnages which are attached to her name in Lloyd's Register, these being "Gross" and "Nett." Both are measured in units of 100 cubic feet, or just 2½ times the freight unit. Gross tonnage is measured as the whole of the space below decks, plus the capacity of deck cabins, chart houses, and other covered structures. Nett tonnage is the difference remaining after deducting the quarters for the officers and crew, navigation and engine space, and bunkers. In other words, nett tonnage is the maximum hold capacity. It varies from 50 to 70 per cent. of the gross tonnage in an ocean going cargo steamer, and, as the cost of a ship is directly related to her gross tonnage whilst her earning capacity is a function of the nett tonnage, it is desirable to keep this percentage as high as possible.

In the case of passenger liners, the ratio of nett to gross is very small, whilst, in one of our typical grain or ore freighters for Lakes service, the nett tonnage will be considerably more than 70 per cent. of the gross. Nett tonnage is the basis of all marine statistics, port and harbour dues, and is the chief factor in the chartering of a vessel for cargo. It will be seen that to ship a 10,000 ton cargo a 4,000 ton freighter will give the required capacity. An exception to this occurs where the cargo weighs more than 2240 lbs. per 40 cubic feet, in which case, perhaps, not more than 25 per cent. in excess of the registered tonnage could be carried. With heavy cargoes, the maximum would depend upon the season, as it would take a greater displacement to sink a vessel to her marks in summer than in winter particularly on the North Atlantic.

Cable Codes

In any office transacting a considerable amount of export business, a great deal of time and money can be saved by a really intelligent use of the cable codes. In addition to the use of the Western Union and other standard codes for the abbreviation of telegraphic messages, it is always desirable for a firm to have a private cipher for cabling their confidential agents and correspondents at foreign points. Such a code will have the great advantage of secrecy; that is it cannot be decoded without the use of the private key. It will also be economical because it can be devised on a five letter system thus enabling any two words to be connected and transmitted as a standard ten letter word. Lastly, the interpretation will have particular reference to the firms own special products, classes of machinery, etc., which a commercial code cannot have. Let us devise such an arbitrary code as the above-mentioned, remembering that three rules must be followed, viz.

(a)—Every word used must be pronounceable (this is a stipulation of the Cable Company to assist their operators in securing accuracy).

(b)—Every word must consist of five letters, and, (c), each word must differ from every other by at least two letters. This last precaution ensures that the multilation of a word in transit will not give a false meaning to the message. For instance, if the word HAMID stands for 1000 and HABID for 2000 an error of transmission changing the M into a B might lead to the shipping of twice as many goods as were ordered.

Another illustration actually taken from the private code of a firm of electric cable makers is in the word LEAPED, signifying "hold order for instructions", and LEANED meaning "hurry forward goods on order." It is easy to see what trouble might result from a mix-up in transmission in this case. If however, every word is two letters different it is in the last degree unlikely that both would be so transposed as to give a false meaning, and, in nearly every case, an error would lead to an unintelligible message which the receivers would promptly have repeated.

Let us take as the root for our code the letter K; this can be followed by any of the five vowels, KA, KE, KI, KO, KU. Now, eliminating the inconvenient letter Q, there are twenty consonants which combined with the above will yield 100 different three letter words; viz. KAB, KAC, KAD, KAF, etc. Lastly comes another vowel and consonant, both of which must change with every word; viz. KABAC, KABED, KABIF, KABOG, KABUH, next, KABJA, KABKE, KABLI, KABMO, KABNU and then KACAP, KACER, etc.

The above illustrates sufficiently the method to be adopted in making up any arbitrary code which shall satisfy all the rules. It may be asked "why not choose ordinary five-letter dictionary words?" The objections are that considerable search would have to be made to ascertain that the words were not already in use in a standard code, and further, with a large list of words it would be a most laborious process to go through them in order to see that they fulfilled the "two letter change" rule. With the revised code above described, this automatically takes care of itself and the words can be made up just as fast as one can write them down.

In attaching meanings to the words, it is useful to let the three letter root denote a class of product and the suffix stand for the size or type. For instance, KAB-may be taken to mean "engine lathe," and the suffix-AC would be 10 ft. bed, or ED 12 ft. bed. KAC-might signify a riveting gun, AP being ½ ins. size, ER ⅝ ins. etc. Such a code as this would dwell in the memory and might find a certain use in private correspondence, stock lists and card indexes, thus saving much time and space. In telegraphing such a code as this two words are always connected regardless of meaning, thus, KEDOBKABMO becomes KEDOB, KABMO, for decoding.

Economy and secrecy are also obtained in cabling by modifying one of the standard codes according to a prearranged plan. This involves using the numbers which are attached to all the words in the code book. Looking through the Western Union, Liebers, or A B C 44th. or 5th. edition, it will be seen that a small proportion of the words are numbered from 100,000 up. This system will only apply to the first 99,000 words so those eliminated should be carefully noted; in any event the method covers the most useful part of the code book. By the use of the following table it will be seen every number from 0 to 99,000 can be represented by a pronounceable word:

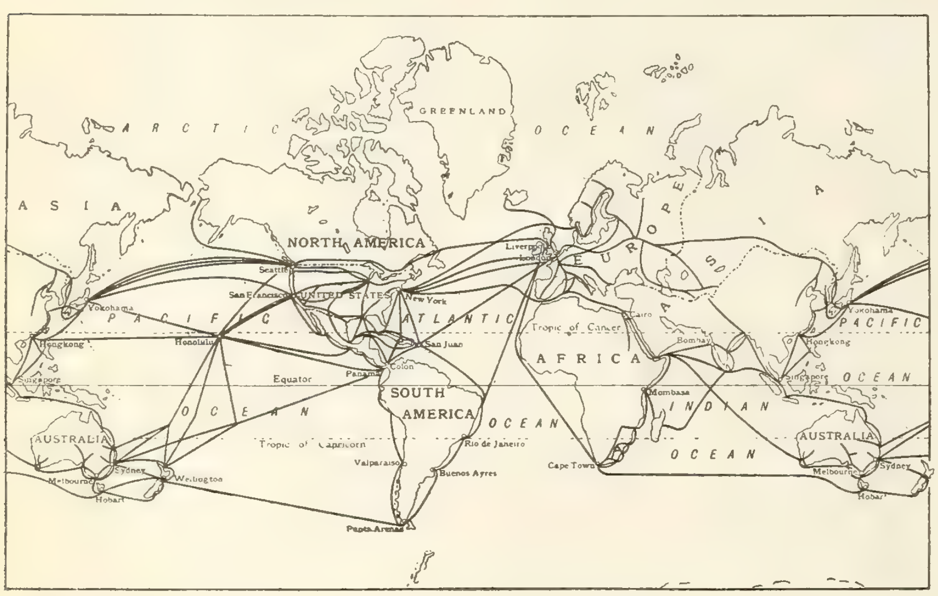
	B	C	D	F	G	H	J	K	L	M	N	P	R	S	T	V	W	X	Y	Z
A	00	05	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
E	01	06	11	16	21	26	31	36	41	46	51	56	61	66	71	76	81	86	91	96
I	02	07	12	17	22	27	32	37	42	47	52	57	62	67	72	77	82	87	92	97
O	03	08	13	18	23	28	33	38	43	48	53	58	63	68	73	78	83	88	93	98
U	04	09	14	19	24	29	34	39	44	49	54	59	64	69	74	79	84	89	94	99

In above table, each number is represented by a vowel and a consonant, in other words by a pronounceable syllable; for instance 36 is KE (or EK), 53 is NO (or ON). To use the table let us take an actual message from the Western Union Code.

34628—Good improperly packed.

44162—Will not hold ourselves liable.

Putting these two numbers together in this way, 34-62-84-41-62, and substituting the proper letters from the table, we obtain JURIWULERI, which in one word carries the same message as the two words in the code. The receiver of such a message will just substitute the figures for the letters, divide the ten integer number into two of five integers each, and look up the meaning in the Code Book. It will be seen that, to represent such a number as 83, the symbol 00083 must be used so as to leave no blank spaces.



SHIPPING ROUTES AND MILEAGE TABLE OF DISTANCES, SHOWING SAVINGS EFFECTED BY PANAMA CANAL PASSAGE.

Distance from New York to Sydney, Australia, via Straits of Magellan	12,546
From New York to Sydney via Panama	9,814
Saving	2,732
Distance from New York to Hong-Kong via Suez	11,460
Distance from New York to Hong-Kong via Panama	11,415
Saving	45
Distance from New York to Yokohama via Suez	13,040
Distance from New York to Yokohama via Panama	9,835
Saving	3,205
Distance from New York to Honolulu via Straits of Magellan	13,269
From New York to Honolulu via Panama	6,687
Saving	6,582
Distance from San Francisco to New York via Straits of Magellan	13,090
From San Francisco to New York via Panama	5,299
Saving	7,791

—Courtesy M.E. & N.A.

A HARD CASE

EVEN the most rabid anti-alien among us can scarcely fail to sympathise with the lot of Captain Riepenhausen, of the Blue Funnel Line, to whom the Admiralty has refused the usual confidential instructions to mariners—and thereby done him out of his job—simply because his father happened to be a German. Riepenhausen, senior, came from Hanover to Scotland at the age of 13 and settled in Broughty Ferry. At the age of 20 he married a Broughty Ferry lady, and the captain is the child of the marriage. He is himself a Scotsman born and bred, and his wife belongs to Aberdeen, but, unfortunately for him, his father neglected to take out naturalisation papers till the son was seven years old. Captain Riepenhausen is thus an alien enemy in the eyes of the law, despite his fine record both as a seaman and as a man. Can it be that, by straining at a gnat of this kind, the authorities hope to atone for the many alien camels they have swallowed since the war began, says the Glasgow *Herald*, and this, too, while our traitor Dukes still retain their place in the Peerage?

$100 for Sharp Eyes.—Sir A. Yarrow, the well-known Clyde shipbuilder, has offered a reward of $100 (up to a total expenditure of $50,000) to anyone aboard a commercial vessel who first draws the captain's attention to the presence of an enemy submarine in the vicinity of the ship.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Captain James Warwick, a well known marine man, passed away at Courtright, Ont., on March 11. Deceased was 72 years of age.

Capt. James N. P. Ritchie, master of the C. P. R. steamer Princess Patricia, died at Victoria on Feb. 21. Capt. Ritchie was born in Yarmouth, N.S., 58 years ago.

James S. Paige, who for some time has been associated with the Fore River Shipbuilding Co., of Quincy, Mass., has been appointed general manager of the Port Arthur Shipbuilding Co.

Capt. James Murray, one of the oldest captains on the lakes, passed away on February 21, at Clayton, N.Y. The deceased was born about 75 years ago in Ireland, but came to Canada at an early age and went into the marine business. For many years he was known in marine circles as one of the most capable of officers in handling boats for the Montreal Transportation Co. During the past year he had been retired.

J. H. Pillsbury, superintendent of the drydock at Prince Rupert, B.C., has been to Vancouver to arrange for engaging a staff and buying ship chandlery general stock for the plant. Mr. Pillsbury came from Winnipeg, where he was authorized by the G. T. P. officials to supervise the installation of a permanent staff. This will enable the plant to bid for all ship repair and overhauling jobs, construct wooden ships, and smaller types of steel craft.

R. S. White Honored.—A number of customs brokers of the City of Montreal met at the Customs House on McGill street, on Saturday, March 10, for the purpose of bidding a formal farewell to R. S. White, on the occasion of his retiring from office after over a score of years of service as collector of customs. The customs brokers took advantage of the occasion not merely to voice their appreciation of the manner in which Mr. White had performed the functions of his office during that time, but showed their feelings in very tangible form, presenting Mr. White with three superb pieces of silverware, and with an illuminated address. While the ceremony was a very brief one, it was marked by a continuance of the warm personal friendly relations that have always prevailed between Mr. White and those who had business to do with his department, and many feeling tributes were paid him by his friends of the business community. John A. Finlayson presided, and called upon S. Whitaker to present the address.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. A. Wright, Toronto. **Secretary**—Francis King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio. Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I. Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

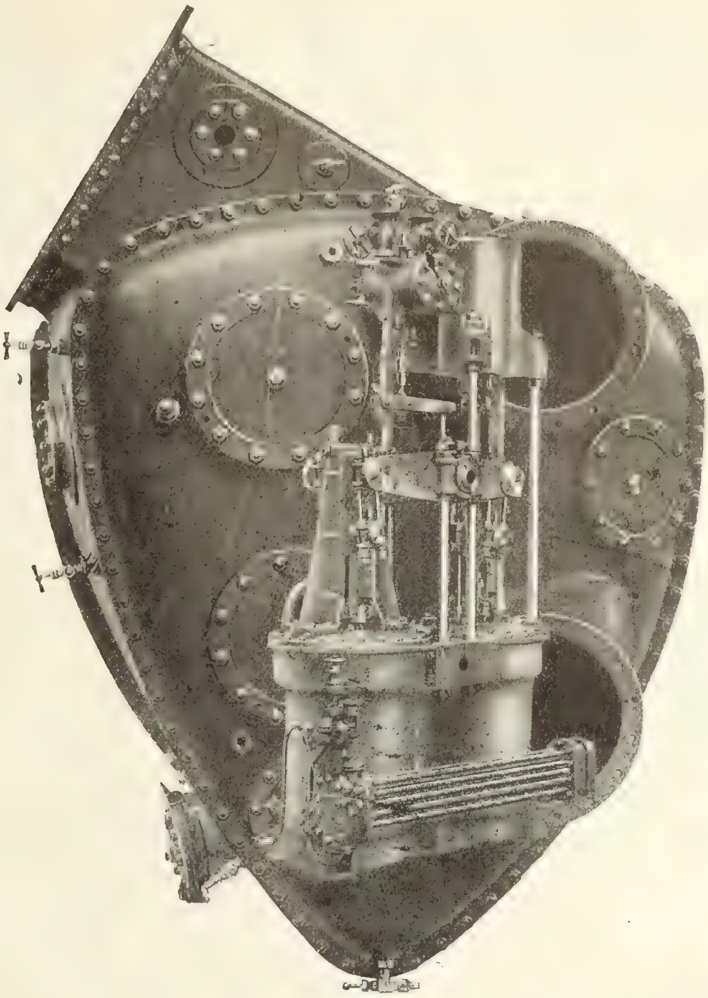
J. W. Norcross, vice-president and managing director of the Canada Steamship Lines, has been appointed director of shipbuilding in Canada, attached to the Naval Service Department. The Government is anxious to immediately carry out an undertaking for the construction of as large a number of merchant vessels as possible at the various shipbuilding works and dry docks in Canada, and has placed the entire undertaking in the hands of J. W. Norcross, with powers to forthwith proceed with the organization of his staff and the placing of the contracts, in order that the largest number of boats may be launched at the earliest possible date.

Capt. Gilbert Johnston, a well-known figure on the St. Lawrence and the Great Lakes, and long actively connected with the Richelieu & Ontario Navigation Co. and the Canada Steamship Lines, Ltd., died at his residence in Montreal on March 13, after a long illness. He was known to practically all of the river and lake steamboat men in this part of the Dominion, and had a very wide circle of friends and acquaintances. Captain Johnston was of Scottish ancestry and was born in Kingston, Ont., sixty-four years ago, being a son of the late Gilbert Johnston. In 1894 he was appointed mechanical superintendent for the Richelieu & Ontario Navigation Co., a position which he filled with conspicuous success. After receiving this appointment he removed from Kingston to Montreal, and resided here for the remainder of his life. He retired from active work with the Canada Steamships, Ltd., six months ago.

Northern Navigation Co. Hold Meeting.—The three days' annual "Get Together" meeting which was held at the offices

1917 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince.	108 Chester Ave.
St. John,	2	W. L. Hurder.	209 Douglas Avenue	G. T. G. Blewett.	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand.	93 Fifth Avenue, Lachine, P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	176 King Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross.	126 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.



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CATHCART, GLASGOW - - SCOTLAND

of the Northern Navigation Co., at Sarnia, Ont., was brought to a close on Friday. The men were gathered together for the purpose of discussing new methods and plans for the coming navigation season. A great benefit is derived by the different officials at a meeting of this kind exchanging views and offering suggestions for the good and welfare and popularizing this well-established line which conveys thousands of passengers and tourists on the Great Lakes every year. The prospects for a big season are very bright, and optimism permeated the meeting. The following officials were among those in attendance: H. H. Gildersleeve, general manager, Sarnia; W. H. Smith, agent of Owen Sound; C. H. J. Bowden, travelling freight and passenger agent, Montreal; W. L. Day, travelling passenger agent, Sarnia; Fred Bentley, chief clerk, Sarnia.

TORONTO HARBOR DEVELOPMENT PROGRAMME

OVER $3,000,000 may be spent on harbor development work this year by the Toronto Harbor Commission in addition to $1,000,000 which the Dominion Government has placed in the estimates for 1917. Detailed plans are now in process of being worked out by the engineering staff of the Commission, and will shortly be submitted to the city by the Commissioners for approval. There is, however, just a possibility that very little work can be undertaken this year, owing to the scarcity of timber, due to export and labor shortage. All timber used this year will have to be brought from British Columbia and present prices are such that the cost may be considered prohibitive. It was originally intended that the new harbor would be completed some time during the year 1921. This is no longer considered possible.

This Year's Plans

Plans for this year contemplate a beginning on the cribbing and piling for the docks in the central district between John and Cherry streets. This work will have to be undertaken in piecemeal fashion so that present dockage facilities will not be interrupted. This year the sinking of piles will, it is expected, only be proceeded with as far east as Spadina avenue. There will also be work along this line, beginning at the old Queen's wharf.

Further reclamation work will be undertaken in Ashbridge's Bay, the industrial district, providing several hundred additional acres for new industries. The Government will be asked to proceed with the retaining wall opposite the Exhibition Grounds and the Harbor Commission will then undertake the work of pumping sand over and filling in.

About $400,000 is to be spent on reclamation work at Centre Island and Hanlan's Point. A block of about fifty acres is to be reclaimed at Centre Island on the immediate west side. Twenty-five acres is to be reclaimed at Hanlan's Point north of the wharf and baseball park. Both of these sections were commenced last year and will, if possible, be completed during 1917.

Estimates for 1917

The estimates of the Harbor Commission show the following contemplated expenditures for 1917:

Construction and acquiring of property, and its equipment, $2,997,763.21; stores and rotary, $41,580; insurance, $23,346; engineering and management, $180,290; revenue producing service, $32,120; upkeep of property and equipment, $11,000. The revenue and proceeds of the Harbor Commission from 1912 to 1916, inclusive, total $6,672,466.78, and the expenditure for the same period was $6,311,775.81, leaving a surplus of $340,690.97. The estimated revenue for 1917 is placed at $160,000.

This year's estimates provide for $60,000 for freeholds in Eastern avenue properties, and $20,000 for the Boulevard-Cliff Road, and $2,000 for a long-time lease hold of the Eastern sandbar. The sum of $150,000 is provided for a new office building. Bath houses, including public protection, are to cost $5,000.

Improve Industrial Area

For roadways there are the following expenditures: Boulevard drive, Cliff Road, $15,250; Boulevard drive, Wilson to the Humber, $87,984; 150 foot roadway, Cherry street to the Don, $10,000, and in the industrial district, $10,000. Sidewalks and curbs call for the following expenditures: Boulevard--Cliff Road to the Humber, $55,000; 150-foot roadway, Cherry street to the Don, $5,000, and in the industrial district, $25,000.

The Cherry street bascule bridge is to cost $50,000, and the Don railway bridge $43,280. Piers, docks, and quays call for $750,369.64, being four sections of the harbor head walls, two of which are under contract. Just where these will be located has not yet been made public. In addition to the above there is an appropriation of $65,000 for the Humber bastion wall.

Underground service appropriations provide for storm sewer overflow extensions at Keele street, Garrison Creek, and Bathurst streets, Booth, Logan and Carlaw avenues, and for a storm sewer in the industrial district, the total estimated cost being $281,591.10. Railways, tramway embankments and tracks will require $60,000.

$708,333 for Dredging

Estimates for non-structural improvements include $658,333 for dredging under the Canadian Stewart Co. contract, and $50,000 for the Harbor Commissioner's plant. An even $100,000 is provided for general retention work and $7,000 is due to be spent on surfacing in the industrial district, in the vicinity of the Sunnyside pavilion and at the Parkdale Canoe Club. The sum of $15,200 is set aside for razing structures and removing obstructions.

Payment of debts and payment to sinking fund will take $296,000. Initial construction of pile drivers, scows and betterments to dredges, derricks, pile drivers, and to tug, will, it is estimated, require $30,000. The sum of $25,000 is in the estimates for a marine railway and $2,350 for power tools. There is also $15,000 for the Sunnyside pavilion and $1,500 for dockyard fences.

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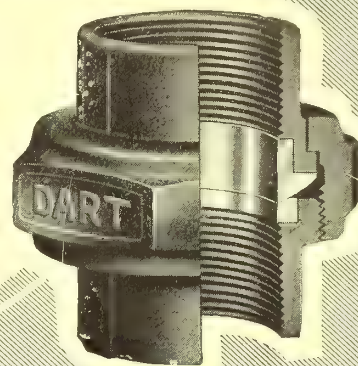

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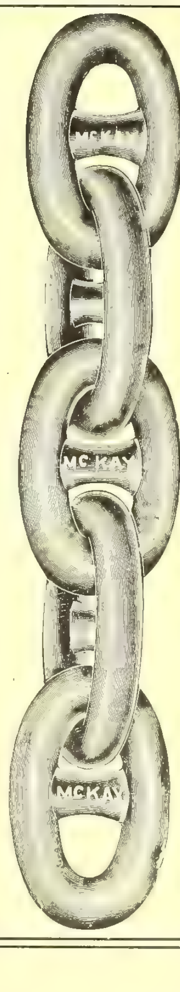

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MONTREAL, Southam Building TORONTO 143-153 University Ave. WINNIPEG, 22 Royal Bank Bldg. LONDON, ENG., 88 Fleet St.

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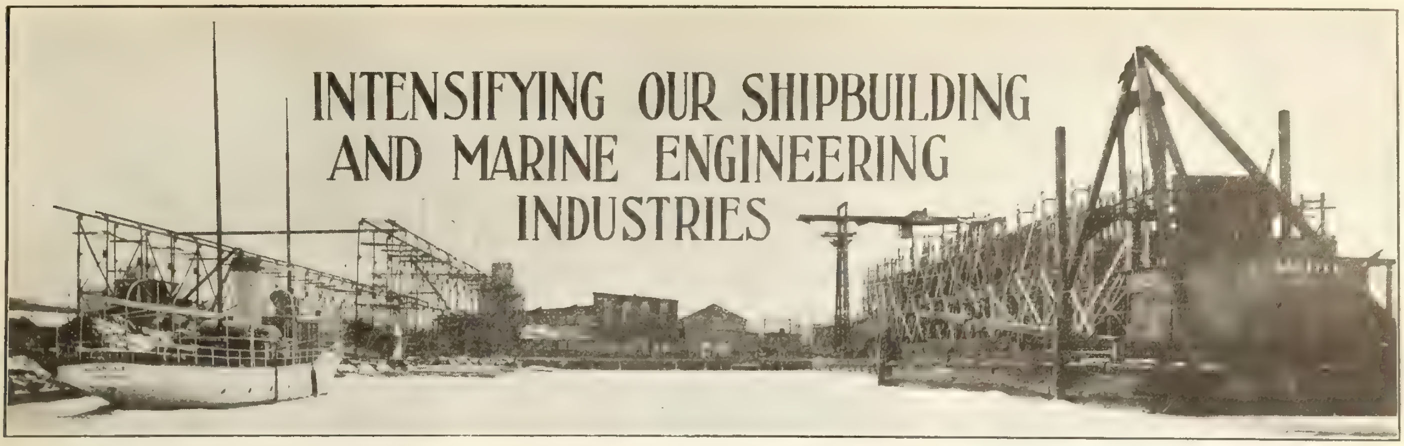
INTENSIFYING OUR SHIPBUILDING AND MARINE ENGINEERING INDUSTRIES



SHIP-BUILDING PLANT OF THE THOR IRONWORKS, TORONTO, LOOKING FROM OFF-SHORE.

By "Drifter"

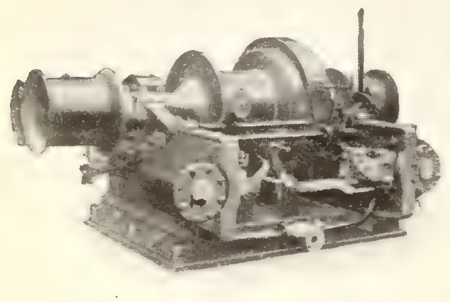
Indications are not wanting that shipbuilding in Canada may not only again flourish, but may quite readily surpass in achievement that of bygone years. Wood ship construction has been revived and promises for a time at least to develop into an industry of considerable proportions. Steel shipbuilding has been given a great impetus, however, and of course to it, more than the other, we look for permanence, and that of a really substantial nature.

THE persistency with which Germany is waging war against the water-borne commerce of the world is certainly not surpassed by her activities in the field, and when results are analysed in each case, and given their proper value relative to the headway we are making towards ultimate and complete victory,it must be admitted that the price being paid in ships on the one hand is equally as costly and as highly undesirable as that being paid in men's lives on the other.

In the past two months, something like one million tons of shipping have fallen victim to mines and submarines. Of itself, this record is sufficiently staggering, although when examined closely, it is seen to be but a more extreme development of a process now many months operative, and which has for its avowed objects either the terrorising of ocean commerce to the point of cessation, or the practical annihilation of same if effort be made to maintain it. The loss of tonnage during February and March of this year through the activities of enemy submarines, and the broadcast sowing of enemy mines on the steamship lanes of the Seven Seas, has been highly abnormal as compared with preceding months of piratical effort, just as much so in that feature as any of the

NORTHERN NAVIGATION CO. STEAMSHIP "NORONIC"—BUILDERS THE WESTERN DRYDOCK & SHIPBUILDING CO., PORT ARTHUR, ONT

preceding war months were highly abnormal to those of peace-time sea-borne traffic. The situation, in a word, is such as to give concern for the future, not altogether with respect to what may happen if the submarine menace be impossible of early complete control or subjugation, but jointly with, or separate as to these eventualities in the matter of the rehabilitation of the world's shipping tonnage, and more particularly that of British Empire Registry.



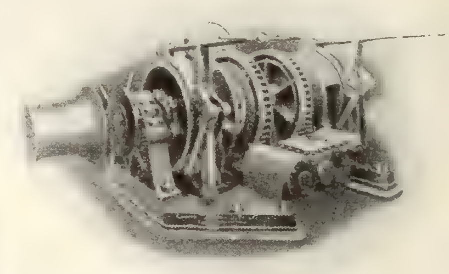
TYPICAL STEAM CARGO WINCH.

Shipping Losses Enormous

At the outbreak of hostilities, world shipping totalled some 50,000,000 tons, of which rather less than half, or, in round figures, 21,000,000 tons was British owned. As might be expected, out of the estimated total vessel losses up to February 1 of this year—2200 ships aggregating 4¼ million tons, Great Britain has suffered most, her share being reckoned as little short of 2¾ million tons. In view of the fact that peace time losses of ocean carriers attain on the average to probably one per cent. of the whole and that wastage to that extent has been war-time operative. it is but reasonable to conclude that the reduction in world tonnage is even more serious than the figures already quoted.

OIL TANKERS, "ROYALITE," "IOCOLITE," AND "SARNOLITE," BUILT BY THE COLLINGWOOD SHIPBUILDING CO., COLLINGWOOD, ONT.

It may be urged of course that, despite the widespread concentration on naval construction by British shipyards for quite an extended period, enough merchant vessel building was being undertaken to offset the "Act of God" losses; besides, neutral countries, and particularly the United States, had done much in that direction. Be this normal loss compensation as it may, the dearth of ocean carriers has reached an acute stage, and while Britain's shipbuilders are again "on the job," and can be counted on to demonstrate at least their old-time supremacy in tonnage output, irrespective of class or kind, there is room and opportunity for her Colonies and for neutrals as well, with the plants and organizations, to bear a capacity share in replacing the wastage, and incidentally in the case of the Colonies of aiding also in sweeping enemy marauders from the seas, and restoring the merited freedom of the latter as early as possible.



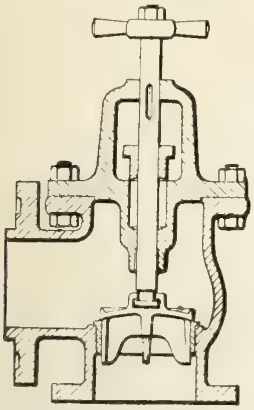
TYPICAL STEAM WINDLASS.

Our Call to Shipbuilding

To Canada then the call has come to participate in the restoration of the Empire Merchant Service, and, judging from the enthusiastic response already given, there is little doubt but that results will compare quite favorably with those achieved in the departments of men, money, and munitions. The work being undertaken has a twofold object—

625-FT. FREIGHTER "W. GRANT MORDEN" BEING LAUNCHED FROM THE YARD OF THE WESTERN DRYDOCK & SHIPBUILDING CO., PORT ARTHUR, ONT.

the combating of enemy submarine activity and mine sowing effort, and the placing in service of a fleet of freighters to more or less standard design from keel to truck, and of carrying capaccities commensurate with shipyard location and facilities. Notwithstanding the high cost of materials entering into vessel construction meantime—steel, finished and semi-finished, also the irksomeness of the steel mill situation as regards delivery, excellent progress is being made on hull, propelling machinery, and general outfit equipment, by those of our shipyards whose establishment and proved competency belongs to years



ANGLE TYPE CIRCULATING PUMP DISCHARGE VALVE

more or less well removed from the meantime emergency.

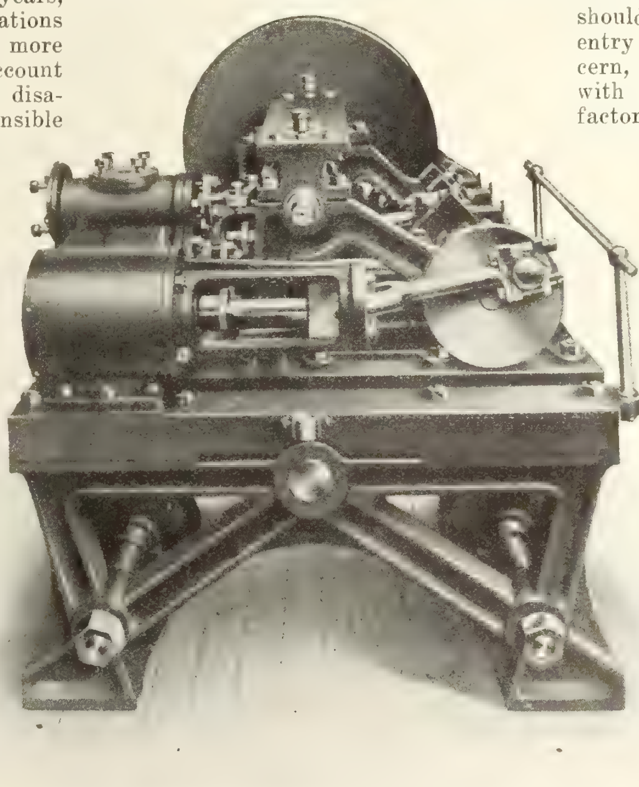
Our Past Accomplishment

To those unfamiliar with what has been accomplished by Canadian steel shipbuilding plants in previous years, the variety type vessel illustrations herewith may prove of rather more than passing interest, and when account is taken of the climatic and other disabilities under which those responsible forthe administration of the various enterprises have labored in the past, considerable surprise may be manifested that so much—both in quality and quantity, has been accomplished. The handicap of climate—long and severe winters in the regions of our lakes, Eastern waterways and ocean shores, has not, however, been the most serious in restricting shipbuilding operations, although due to the hitherto fluctuating nature of the demand for new construction, and its general sparseness in volume—tonnage and individual vessel constituent, little effort has been made to reduce the climatic disability to the extent that building as well as fabricating operations could proceed uninterruptedly the year round.

Even in the Old Country, where the winters are less prolonged and correspondingly less severe, roofed-over sheds amply equipped with natural and artificial lighting facilities, lifting and

MARINE TYPE TWIN SAFETY VALVE.

transportation conveniences are provided whereby the employees go about their work under conditions giving the maximum degree of both comfort and safety. There is of course the further gain, in that greater expedition is possible in the matter of output. To the writer's knowledge, only one Canadian shipyard, that of Canadian-Vickers, Montreal, has its shipbuilding berths shed-equipped, although we shall be much surprised if quite a large percentage of the new shipyards now being established, as well as the other meantime going concerns, do

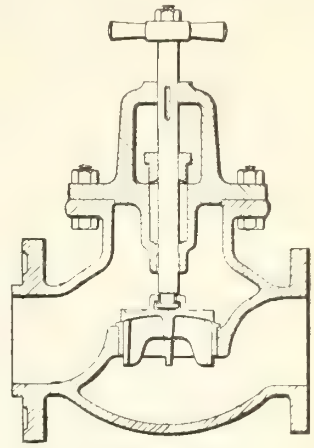


HORIZONTAL TYPE STEAM STEERING ENGINE.

not include in their projected or immediate future plans some such indispensable aid, so as to more effectively embrace the unusual opportunity now offering, and thereby make a material contribution to their world-competitive status.

Making Shipbuilding a Staple Industry

The existing situation, and undoubtedly that of the coming years demand that Canada enter more largely into the business of shipbuilding. Preceding the war, the stumbling block to our development of the industry was, as already stated in connection with the shipbuilding berth matter, both the lack and uncertainty of demand for new construction, due wholly to European competition. From the loss figures previously



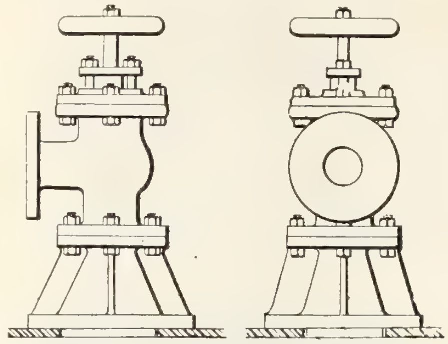
GLOBE TYPE. CIRCULATING PUMP DISCHARGE VALVE.

quoted it will be readily apparent that the demand is now not only of extraordinary proportions but of the most imperative nature; and must needs be satisfied. While, therefore, no stone should be left unturned to make our entry one of urgent and immediate concern, let us see to it, that we do so with a due appreciation of the various factors operative in favor of or against positive success and substantial permanency.

Class of Labor an Essential

Class and cost of labor—not necessarily that pertaining to shipbuilding only, have militated in considerable degree against our competitive ability in a world sense. Due to the intermittent vessel demand, however, it has been wholly impossible for our shipyards to maintain either an expert staff or more than a mere handful of mechanics trained to the work of shipbuilding. As a result, with little permanency of employment in sight, men drafted, as we might say from the "four winds," with neither stake in the shipyard nor in the citizenship of its town location, could not on occasion be expected to produce results commensurate with those of

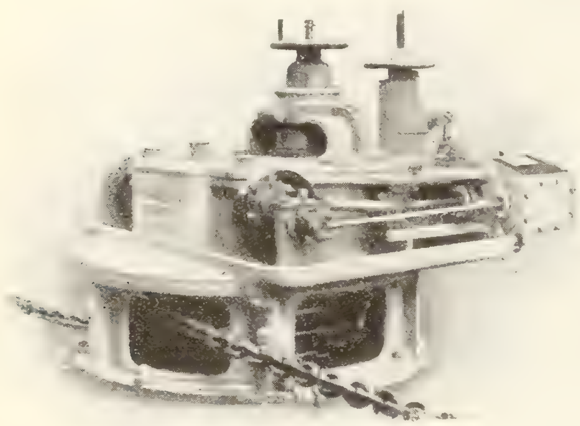
their fellows on say the Clyde, at Belfast, on the Tyne, Tees or Humber, in Great Britain, where employment in the various departments of shipcraft has been and is to all intents and purposes of a quite permanent nature. Under the latter circumstance the "'bird of passage'' tendency gives place to more or less permanence of residence. Again, even where we have in the past requisitioned unskilled local help, the practical training process has been largely unsatisfactory on account of lack of technical training facilities, and where these have been available, there has not infrequently been an insufficiency of elementary or day school education to enable the worker to appropriate the technical instruction offered. While, therefore, it will doubtless be possible to import, so to speak, not only a number of men skilled in directing shipbuilding operations in detail, and a fair muster of others with more or less experience of the everyday routine of vessel construction, it will be an absolute necessity, and more so as regards new enterprises that a service enlistment proposition be made our young men which will make it worth their while to enter shipbuilding and marine engineering—one branch or another, as a life craft or profession. To ensure success in this respect, among the other plans and projects being devised and developed, the plant executive, as is done in Great Britain, must arrange to provide instruction courses, whereby what would otherwise indicate but a year-in and year-out monotonous routine leading to nowhere in particular, a lad's interest in his work and his ambition to rise to a place of prominence in his profession would receive the necessary stimulus. With the prospect of at least a handful of years of boom shipbuilding ahead, and a fair chance of the industry finding a permanent establishment, of scope hitherto unapproached, schemes for developing the quality of help should on no consideration be overlooked, be wilfully omitted, or be marked by indifference.



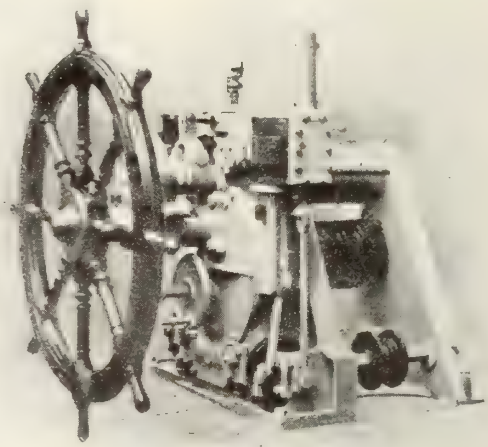
TYPICAL SEA SUCTION VALVE.

Cost of Labor

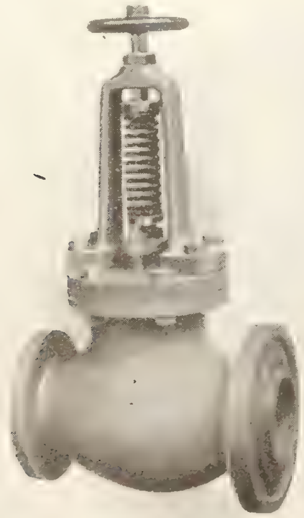
Aside from the cost of material entering into ship construction, no other factor has probably contributed to the lack of opportunity for vessel building in Canada so much as that of labor cost. For the like reason shipbuilding in the United States was in pre war days hopelessly outclassed as against European enterprise. Labor is a primary essential in every business worthy the name, and while its individual productive capacity may, as we have seen, leave little scope for sifting out and replacement, it is well-known that its assessed value, which must often be accepted without demur, is in many instances altogether out of proportion to its output value, and of course in a direction quite foreign to the stimula-



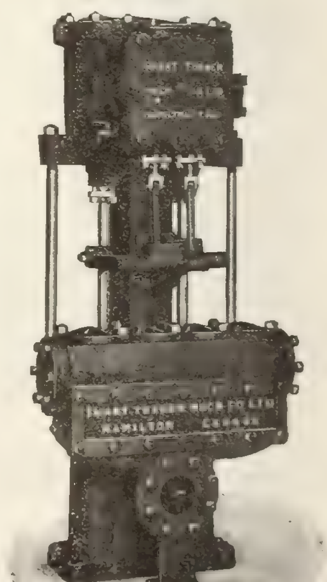
HORIZONTAL TYPE STEAM STEERING ENGINE.



VERTICAL TYPE STEAM STEERING ENGINE.

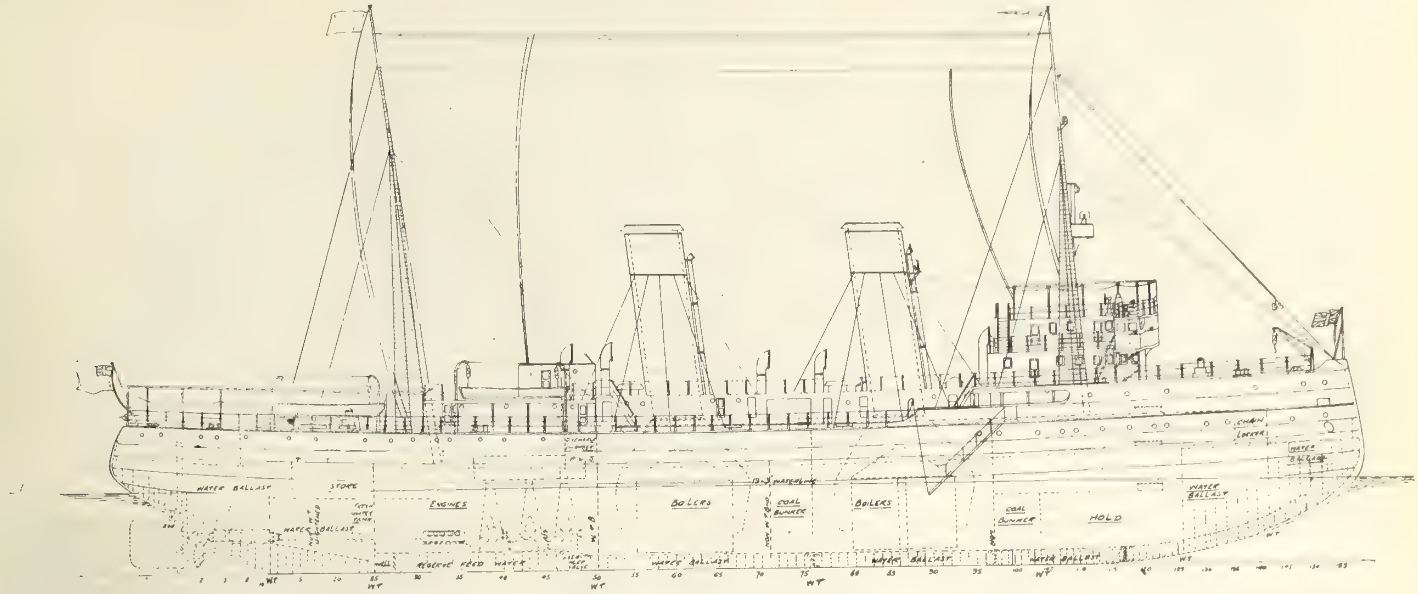


GLOBE TYPE—AIR PUMP DISCHARGE VALVES.—ANGLE TYPE.



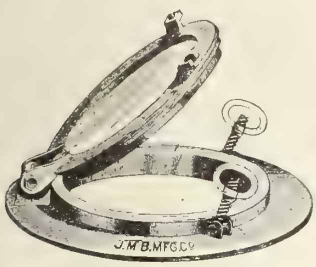
TYPICAL BOILER FEED PUMP.

tion of competition in the world's ship market. We will abstain from making direct comparison between shipyard employees wages in Britain and those in



ICE-BREAKER "J. D. HAZEN," BUILT BY CANADIAN-VICKERS, LTD., MONTREAL.

Canada ante-dating the war, believing that no useful purpose would now be served if we did so, for the reason that

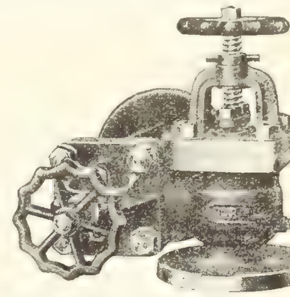


SHIP'S LIGHTS.

a cleavage has taken place as a result of the varied war activities. It is our opinion that the degree of wage uniformity in Great Britain and Canada now prevailing will be little disturbed when munitions and other forms of war effort cease. Suffice it perhaps to say here, that previous to the opening of hostilities, the difference between wages paid in Great Britain and those in Canada was in itself sufficient to place Canadian shipbuilders well beyond the pale of being serious competitors in the world ship market. Labor quality and labor quantity will, it seems to the writer, exert a more marked influence on the development, continuity, and permanence of Canada's shipbuilding industry during what may be termed its crucial or testing period, i.e. the next decade, than will any question of labor cost.

Material Cost

The question of cost of materials entering into shipbuilding and marine engineering has a many-sided aspect, and it is just possible that investigation even in a more or less superficial and general way of the more important considerations requiring attention may be of interest and profitable when studied from say a comparative viewpoint. On the assumption that labor costs are now to all



"BEAVER" COMBINED STOP AND CHECK VALVE.

intents and purposes equalized, and taking the cost of material pure and simple

IRON WORKERS SHED, CANADIAN-VICKERS, LTD., MONTREAL.

CAULKING THE MAIN DECK OF 200 FT. O.A. AUXILIARY POWERED WOOD SCHOONER.

shipyards, it may be said that, with the exception of the recently equipped plant of the Nova Scotia Steel & Coal Co., at New Glasgow, N.S., none of the others are in any sense close to the sources from which they draw their raw, semi-finished and finished material. Shipyard location in Canada, while influenced to some extent by its relative bearing to supply sources, has been determined largely by other considerations. Our lakes and Pacific Coast shipyards cannot by any stretch of imagination be said to have been established in the heart of dis-

as between Great Britain and Canada, what do we find? Materials of construction, whether for vessel hull, or miscellaneous equipment have been and still are for the most part imported by Canadian shipbuilders and marine engineers. Great Britain on the other hand is practically self-sufficient for her shipbuilding requirements, and in the light of her output capacity this is saying a great deal.

It has been urged that as in labor costs so in those of material, there is meantime, little, if any, difference in the price British shipbuilders are called upon to pay for, say steel, a circumstance due of course to the abnormal demand for that material for munition purposes as well as for shipbuilding, and to her having to supplement her domestic production by import as in our case. It should, however, be borne in mind that the situation in Britain is not only highly abnormal these days, but of quite a temporary nature, and that so far as Canadian competition is concerned, the conditions we will have to meet when the demand for munitions steel, etc., ceases, will be approximately those of Britain's pre-war days, and with steel of her own manufacture. This, needless to say, will be more largely and readily available, because of the additional domestic productive capacity created by the war needs. A readjustment of steel prices favorable to British shipbuilders may reasonably be looked for following the cessation of hostilities.

UNDER THE BILGE OF AN AUXILIARY POWERED WOOD SCHOONER.

Plant Locations in Canada

Of our present established group of shipyards, it may be said that, with the exception of the recently equipped plant of the Nova Scotia Steel & Coal Co., at New Glasgow, N.S., none of the others are in any sense close to the sources from which they draw their raw, semi-finished and finished material.

tricts teeming with first essentials of shipbuilding. They are, however, more or less well situated for import of their requirements by water from the U. S.

Our lakes shipyards are handicapped when it comes to building even medium tonnage vessels for ocean service by reason of the insufficiency of canal accommodation via Montreal and the St. Lawrence to the sea, and while even now, on the upper lakes at least, freight and passenger ships of over 600 ft. in length have been built and are building, their service scope is restricted, with the result that the construction demand is quite intermittent. No limit as to vessel size is imposed on our Pacific Coast builders, yet the lack of proximity to the sources of supplies contributes to about the same ultimate outcome in progressive competi-

AUXILIARY POWERED SCHOONERS OF WOOD, 260 FT. OVER-ALL LENGTH, BUILDING AT NORTH VANCOUVER, B.C.

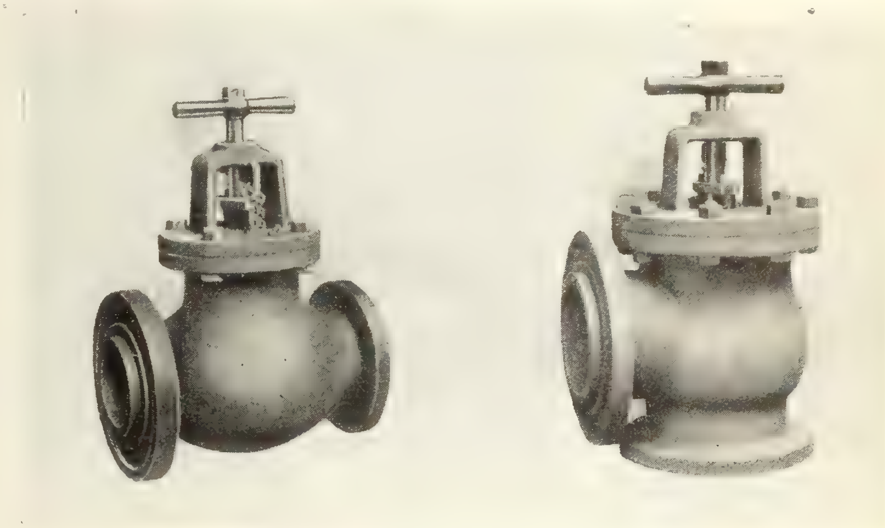
ONE OF THREE LIGHTERS BUILT BY POLSON IRON WORKS, TORONTO, FOR CANADIAN GOVERNMENT SERVICE ON HUDSON BAY.

tive development as does that of our lakes plants. In either case, however, the shipyards established are a necessity, if not solely for new construction, then for repairs and overhaul, and it may be accepted that the plants at Toronto, Collingwood, Port Arthur and on the coast of British Columbia have been installed at strategical points, to undertake such work promptly and effectively. That they have been doing so profitably alike to themselves and vessel owners is well-known, and in the matter of building canal size craft—260 feet over-all length, they have exhibited commendable enterprise, and have been rewarded with well deserved success.

GUIDE SHEAVES FOR SHIP'S TELEGRAPHS.

Plant Locations in Great Britain

In Britain, so far as rivers go, comparatively, there is nothing spectacular about the Clyde, Mersey, Tyne, Tees, Humber, etc. All of them are comparatively modest in length, navigable waterway, and otherwise attractiveness, yet they have appealed to shipbuilders, and have become famous on that account. Not one of them is a ghost, however, of its former self, and altogether to their specific location and possibilities have the sweeping changes and costly developments been attributable. Their location has given them importance because of their running through the heart of districts abounding with just such essentials of shipbuilding, engineering, and general manufacturing as permit of their ready appropriation, reduction, fabrication and transportation to world markets made and in the making.



CIRCULATING PUMP DISCHARGE VALVES.
Globe Type. Angle Type.

If, then the shipbuilding industry in Canada is to have competitive rank with that of Great Britain, it surely becomes absolutely necessary that plant establishment and development should have careful consideration. In the writer's opinion shipbuilding for ocean service is only competitively possible on our Eastern shores as far inland as the city of Montreal. With this statement, there will be found few to disagree. Montreal is the head of ocean navigation for Eastern Canada, besides being the chief port of the whole Dominion. Even in her case it may be said in passing that convenience to the sources of raw materials entering into shipbuilding and marine engineering is not as desirable as could have been wished for, nevertheless, by virtue of her ocean navigation headship, and her multiplicity of metal-working and kindred industries, more or less of which are necessary feeders for shipbuilding and marine engineering on a large scale, she doubtless may be expect-

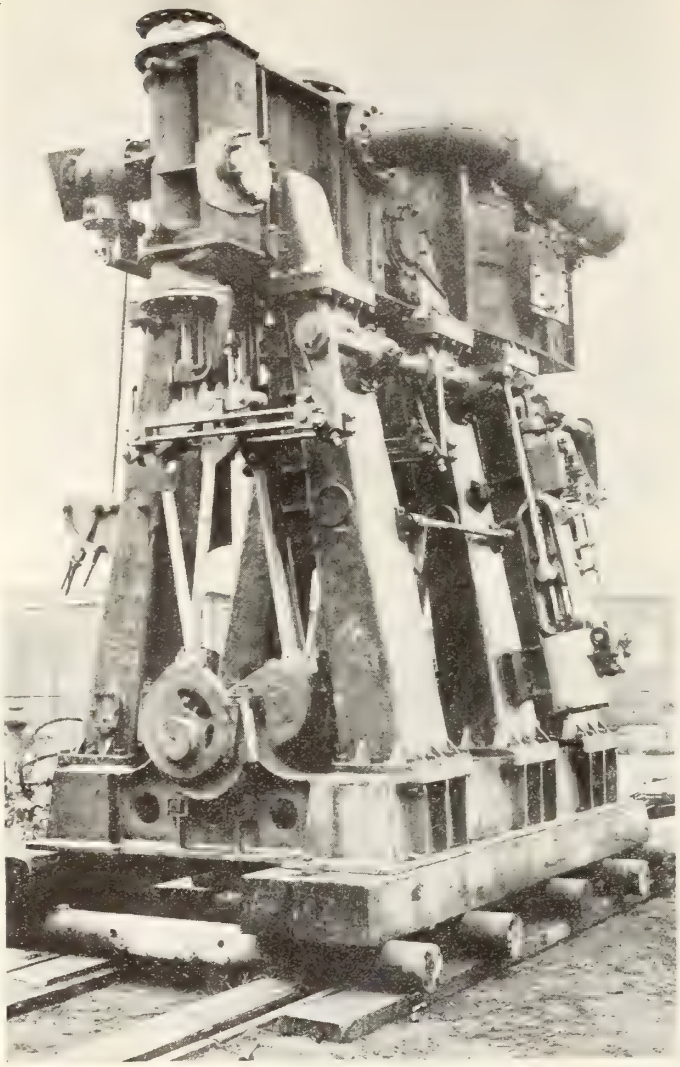
BUCKET DREDGES BUILT FOR THE CANADIAN GOVERNMENT BY THE COLLINGWOOD SHIPBUILDING CO., COLLINGWOOD, ONT.

ed to make a substantial and successful bid for vessel contracts against the world in the coming time.

The meantime centre of Canadian shipbuilding and marine engineering effort is the plant of Canadian-Vickers, Ltd., of Montreal, the volume and variety of work under construction there easily surpassing that being undertaken elsewhere in the Dominion. In addition, it has been constituted the distributing centre for numerous marine engineering contracts, the filling of which is being expeditiously carried out by well known Canadian engine and boiler builders over a comparatively wide area.

Shipbuilding Plants Projected

Since a full realization of the opportunities afforded us of taking a hand in the restoration of our Empire shipping has been grasped, many shipbuilding concerns have been incorporated, and not a few have already taken the preliminary steps of securing expert advice, and examining suitable sites. As bearing out what has been already indicated, it is noteworthy that without exception possibly, investigation is being made of locations on or adjacent to the Atlantic seaboard. Private enterprise, as might be expected, is being substantially backed and encouraged by a number of municipalities, prominent among which may be noted Three Rivers, Que.; St. John, N.B.; Halifax, N.S., and Sydney, N.S. Provincial Government aid is not lacking either, for as recently as March 23, a Bill, entitled "An Act for the Encouragement of Shipbuilding Within the Province," was introduced in the House of Assembly, Halifax, N.S., by Premier Murray. The Bill authorizes the appointment by the Governor-in-Council of a Commission, to be known as the Shipbuilding Commission, to consist of five commissioners and a secretary. The duties of the Commission are to investigate the facilities existing within the province for the building of ships and the manufacturing industries incidental thereto, and to make suggestions tending to the adoption of practical rules and regulations to encourage the utilization of all natural and other resources calculated to facilitate the development of the shipbuilding industry within the province. The Commission is empowered to engage whatever technical or expert assistance is necessary.



TRIPLE EXPANSION JET CONDENSING PROPELLING ENGINES OF 900 I.H.P. FOR CANADIAN GOVERNMENT BUOY STEAMER "GRENVILLE."

The Bill provides that the Commission may, by Order of the Governor-in-Council, be created a body corporate, and when so created shall have power:—

To construct, purchase, lease or otherwise acquire ships and shares in ships, and to equip, maintain and operate any ships so acquired.

To establish, equip, maintain and operate any manufacturing plant for the manufacturing of ships of iron, or steel, or wood, or any combination of metals of like character.

To enter into any contracts with any company or corporation for the acquisition of any shipbuilding plant, and to acquire and exercise the power, rights, franchise and privileges, and assume the

CAR FERRY "ONTARIO NO. 2" BUILT BY POLSON IRON WORKS, TORONTO.

ELECTRICALLY OPERATED GANTRY AND SHIPBUILDING BERTH AT THOR IRON WORKS, TORONTO.

obligations of any company or corporation whose undertaking is purchased, leased or otherwise acquired by the commission.

To promote any company or companies for the purpose of acquiring all or any property of any company, or for any other purpose which may seem directly or indirectly calculated to assist in the development of shipbuilding industries within the province.

To purchase, lease or otherwise acquire any real and personal property, and any right or privilege which the commission may think necessary or convenient.

A number of other objects and powers are enumerated. The Bill then provides the usual pro forma powers and authority, by the Governor-in-Council, to issue bonds, expropriate lands and to grant Crown Lands.

The Governor-in-Council is authorized to raise by loan on the credit of the province the sum of $2,000,000, and the interest raised by the sale of Nova Scotia debentures or consolidated stock is to be paid into the Provincial Treasury and

GRAVING DOCK AT LEVIS, QUE., WITH FREIGHTER UNDER REPAIR. DAVIE SHIPBUILDING & REPAIR CO.

NORTHERN NAVIGATION CO. STEAMSHIP "HAMONIC," BUILT AT COLLINGWOOD, ONT.

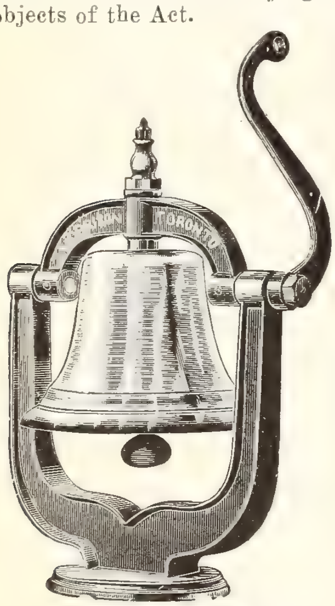
used for the following variety purposes:

Payment of any expenses incurred by the Commission in the carrying out of the objects of the Act.

Any subsidies granted by the Governor-in-Council to the Commission, or to any company engaged in the building, equipment or operation of ships.

Payment of obligations which the Commission may incur in the carrying out of its objects.

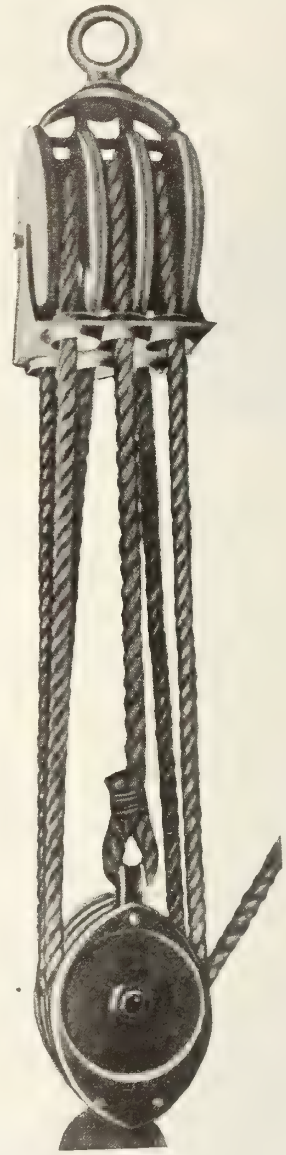
The Governor-in-Council is authorized to enter into any contract for the development of the shipbuilding industry in the province, and to grant subsidies to the Commission or any shipbuilding company within the province.



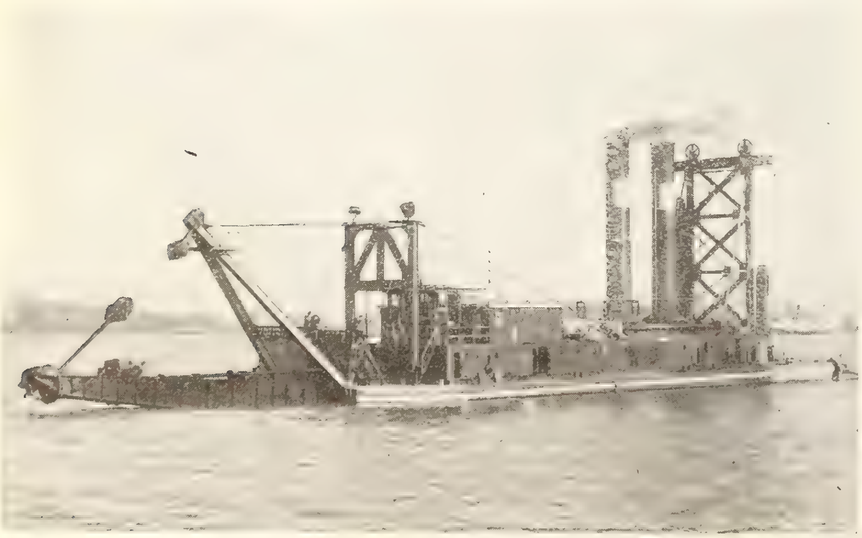
SHIP'S BELL.

Shipbuilding Plant at Newcastle, N.B.

Within the last few weeks advices reached us that the International Shipbuilding Corporation, recently formed with a capital of $2,000,000, had decided to locate a plant at Newcastle, N.B., the site determined upon having been that on which wooden ships were built when that feature of the industry flourished in the Maritime Provinces. In addition to a water frontage of some 1,600 feet, and a depth of water available to float ships of at least 10,000 tons, the town of Newcastle is admirably located for procuring at reasonable cost the bulk of the lumber entering in ship construction and equipment. Not only so, within its borders and quite adjacent are several lumber mills, etc. The layout of the plant is in the hands of a naval architect of Boston, Mass., and among those interested in the undertaking are E. A. McCurdy and L. H. McNaught, of the town of Newcastle. The latter is managing director of the Maritime Foundry & Machine Works there, which enterprise, it is understood, will be absorbed by the shipbuilding corporation.



"HIGGINSON" NON-TOPPLING BLOCKS FOR LIFEBOATS.



24-INCH HYDRAULIC SUCTION DREDGE BUILT BY POLSON IRON WORKS, TORONTO, FOR HARBOR DEVELOPMENT WORK.

Shipbuilding at New Glasgow, N.S.

As is well known, the Nova Scotia Steel & Coal Co., New Glasgow, N.S., in view of the shortage of "bottoms" a year ago, and the effect it was beginning to exert on the various steel producing activities at their Newfoundland, Sydney Mines, and New Glasgow plants, decided to try the experiment of building at least one vessel, the design, constructional, and equipment features of which would meet the requirements of their own or that of any manner of freight-carrying service. Work on this ship, as also on her propelling and auxiliary ma-

chinery, is now well advanced, and is being pushed forward with the utmost despatch, and her launch, which will be a red letter day, not only in the town of New Glasgow, but throughout the Maritime Provinces generally, is scheduled to take place on an early date. The building of this vessel is pioneer work in every sense of the term, as she will not only be the first steel ocean-going freighter to be constructed in our seacoast provinces, but in the matter of her propelling machinery she will evidence a forward step so far as Canada is concerned in the sphere of marine engineering. In a word, she will be propelled by De Laval impulse type steam turbines of 1,000 B.H.P.

An illustration of the vessel appears on page 71 of this issue which together with the accompanying specification covering her principal features, gives some fair appreciation of the task that the management of "Scotia" has set itself to realize, and the more so when it is stated that the whole enterprise began at rock-bottom, so to speak—selecting, clearing, and preparing a building site.

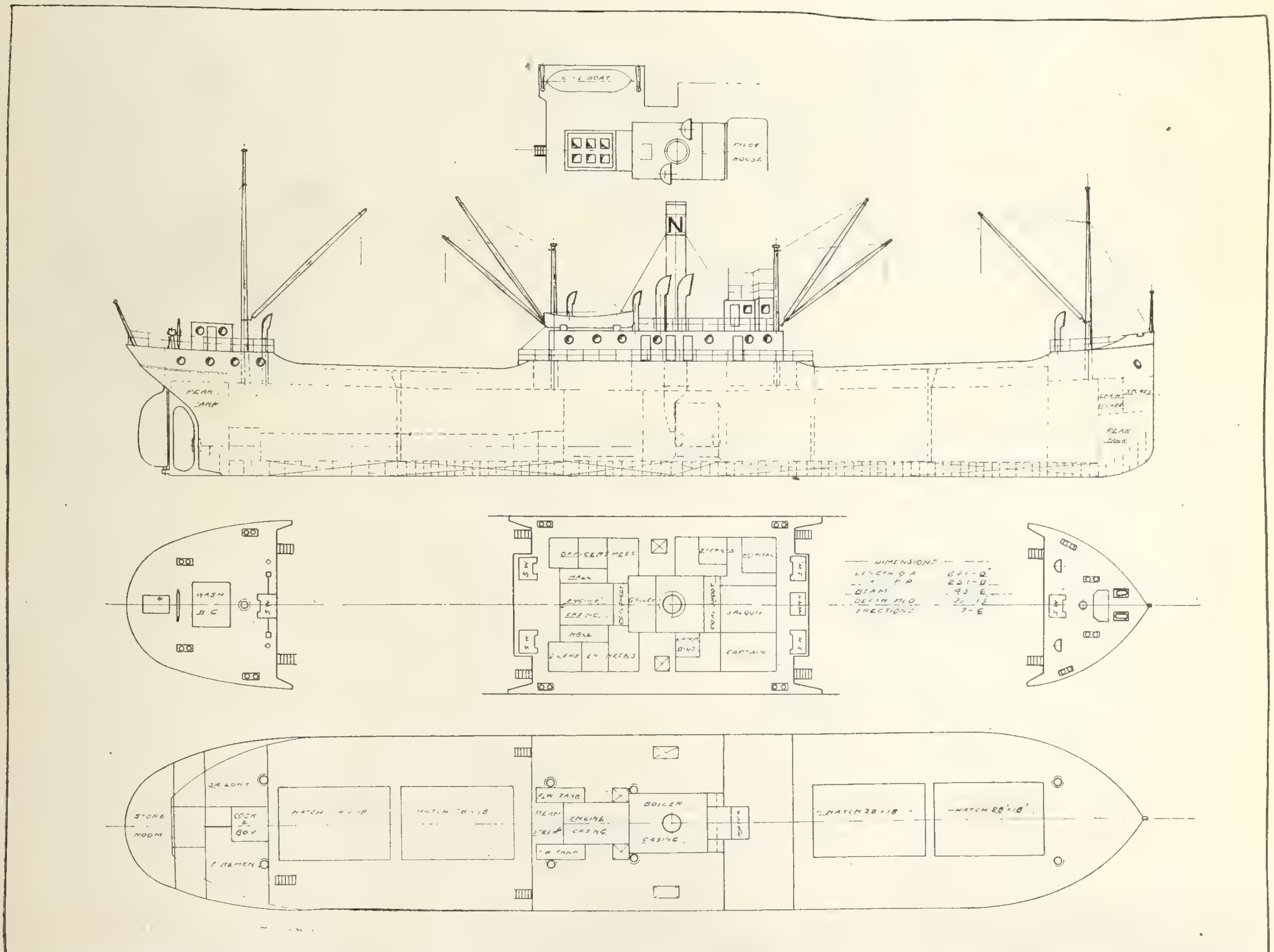
The principal dimensions of the vessel are as follows:—Length over-all, 230 ft.; length between perpendiculars, 220 ft.; breadth molded, 35 ft.; depth molded, 20 ft.; load draft, 17 ft.; carrying capacity, 1,900 tons; displacement loaded, 2,870 tons; speed, 10 knots. The vessel is being built to Lloyd's 100 A1 class. She is of the single deck type,

STEAM PRESSURE GAUGE.

with bridge and topgallant forecastle, the propelling machinery being placed amidships. The forecastle deck is 26 feet long, while the length of the bridge deck is 56 feet. She is provided with complete double bottom, 34 inches deep, of the cellular type, constructed with solid and open floors, having centre division and two longitudinal girders on each side, running the entire length. The space between the bottoms is arranged for water ballast, so that a desired draft can be obtained when the ship is sailing without cargo.

Four water-tight bulkheads, extending to the main deck, divide the cargo holds, of which there are two, from the machinery space and peaks. The forward hold has two hatchways, each 28 ft. 9 in. long, by 19 ft. wide, one hatchway of the same dimensions being fitted to the after-hold. Two steel masts are fitted, each about 55 ft. high above the main deck, and for the handling of cargo the foremast will be provided with two derricks, while the mainmast will have one, each derrick having a lifting capacity of three tons. For this purpose deck winches of the latest type are being installed.

The frames are spaced 23 inches apart from the stern post to just abaft the collision bulkhead, where they are spaced 20 inches, and, to cope with ice conditions, the spacing in the forepeak is reduced to 17 inches, with heavy side plating at the load water line. This, together with panting beams and string-



SINGLE SCREW STANDARD FREIGHTERS OF 3,500 TONS DEADWEIGHT BEING BUILT BY POLSON IRON WORKS, TORONTO.

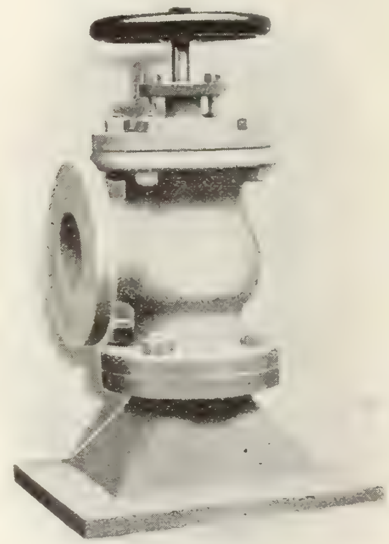
C.P.R. WESTERN LAKE STEAMER "BONNINGTON," BUILT BY POLSON IRON WORKS, TORONTO.

ers, makes the vessel exceptionally strong at the forward end. In the fore-hold, at a point between the two hatchways, a deep web and arch frame has been fitted 30 inches wide, with large brackets to the deck, thus eliminating stanchions and leaving the hold clear of obstructions.

At the fore end of the bridge is a deck house containing, on the bridge deck level, the captain's room, one spare room, steward's room, dining room, pantry, stores, and other offices. Above this is the chart room, pilot house, and navigating bridge. Abaft of the captain's quarters, the chief officer and chief engineer, together with the junior officers and engineers are housed, as is also the cook. Accommodation in the forecastle is provided for five seamen and four firemen. Here also is located the crew's wash room, lamp room and dunnage room.

The propelling machinery is being supplied by the De Laval Steam Turbine Co., Trenton, N.J., and consists of an impulse type steam turbine capable of developing 1,000 b.h.p. when running at a speed of 4,000 r.p.m. This is reduced to 80 r.p.m. at the propeller through two sets of reduction gears. The gears are lubricated with oil from a tank placed on the main deck. A separate pump is used to draw the oil from gear casings and deliver to this tank through a water cooler. There is also a separate pump to supply cooling water. Air and circulating pumps are driven by a separate engine capable of maintaining a vacuum of $28\frac{1}{2}$ inches in the condenser with the engines developing full power. There is the usual installation of ballast, general purpose feed and bilge pumps.

Steam is furnished by two Scotch type marine boilers, each 11 ft. 6 in. in diameter and 11 ft. 6 in. long, their working pressure being 185 lbs. per sq. inch. The steam steering engine is placed on the main deck aft, with chain drum extending through the bridge bulkhead. The winches, three in number, are of the usual type, and have been designed and built by the Pictou Foundry & Machine Co., Pictou, N.S. The propelling engines are the first of this type to be placed on any ship in Canada. They are also the first set of De Laval turbines to be placed on any ship, although since receiving the "Scotia" contract, the makers have secured orders for thirty of a similar type to be placed in vessels now building in the United States.



TYPICAL SEA SUCTION VALVE.

TYPICAL CANADIAN FLOATING DRY DOCK WITH VESSEL ABOARD.

Shipbuilding in Wood

Enough has probably been said to indicate that the future development of the Canadian shipbuilding industry from a world competitive standpoint will be largely confined to our waterway and ocean shore territory from Montreal eastward. We do not, of course, lose sight of the fact that our inland lake and Pacific Coast shipyards will continue to contribute quite materially to our total annual outputs as they have done in the past, nor do we fail to recognize how essential they are for repairs, dockings, and overhauls, at such

sheltered and traffic strategical points as Toronto, Kingston, Collingwood, Port Dalhousie, Welland, Port Arthur, Victoria, Vancouver, Esquimalt and Prince Rupert.

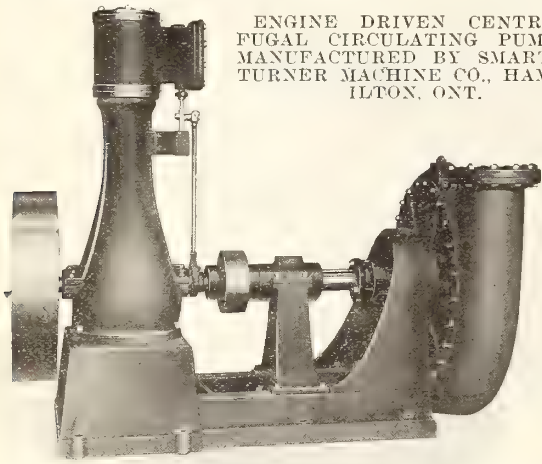
Shipbuilding is booming on our Pacific Coast, as perhaps never before in its history, both wood and iron craft of hefty tonnages being under construction and not a few, particularly the auxiliary powered wooden schooner type, being already completed or approaching that stage. Shipyards on the Pacific Coast are admirably located for wood construction, lumber of every class and kind being abundant and readily convenient. Much enterprise has been shown in tackling this work of building substantial ocean-going craft in wood, and the success of the effort not only on our Pacific shores, but on those of the broad Atlantic, is no less commendable than that in evidence relative to steel construction. Wood shipbuilding, once our pride, has, in this war-created emergency, been revived, and to an extent, little, if any, short of its most palmy days in our midst. It has temporarily stopped the gap caused by delayed new construction in steel, through the abnormal demand for that commodity for other purposes, etc. Ton for ton, wood construction is cheaper, and while, dur-

OFF-SHORE PANORAMIC VIEW OF COLLINGWOOD SHIPYARD, HARBOR AND TOWN.

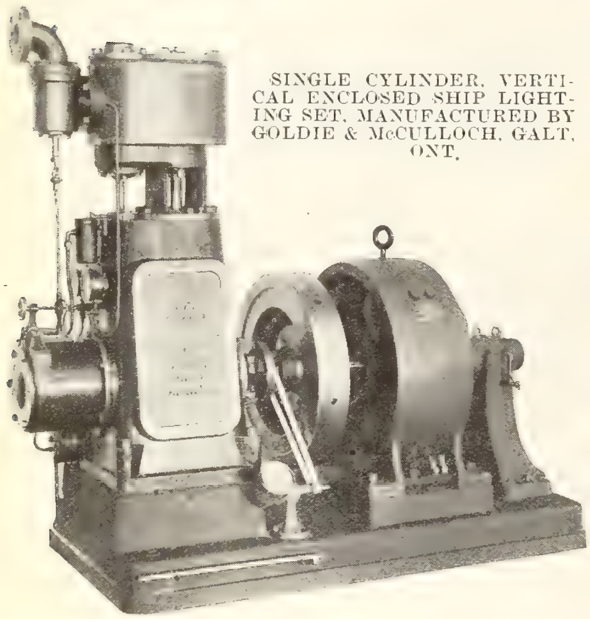
LAKE FREIGHTER "J. H. G. HAGARTY," READY FOR LAUNCHING AT COLLINGWOOD, ONT.

TYPICAL CANADIAN FLOATING DRYDOCK WITH TWO SECTIONS OPERATING INDEPENDENTLY.

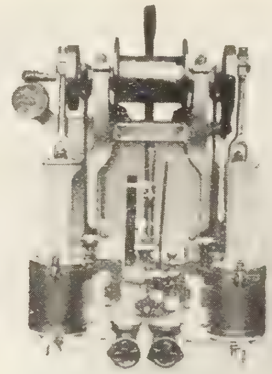
ing the course of the war, with the continued activity of enemy submarines and the risks of colliding with mines, wooden craft are no doubt more vulnerable, the fact remains that their cost as compared with steel vessels, is less burdensome should disaster supervene. Chief among the Pacific Coast firms building wooden craft on a large scale are the Cameron Genoa Mills Shipbuilders, Victoria, the Wallace Shipyards, North Vancouver, and John Coughlan & Sons, Vancouver.

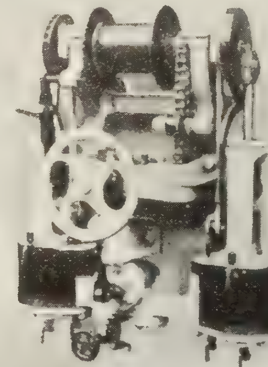


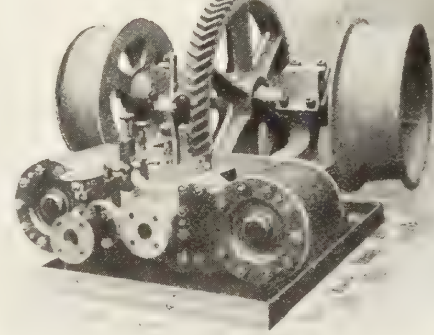
ENGINE DRIVEN CENTRIFUGAL CIRCULATING PUMP MANUFACTURED BY SMART-TURNER MACHINE CO., HAMILTON, ONT.



SINGLE CYLINDER, VERTICAL ENCLOSED SHIP LIGHTING SET, MANUFACTURED BY GOLDIE & McCULLOCH, GALT, ONT.

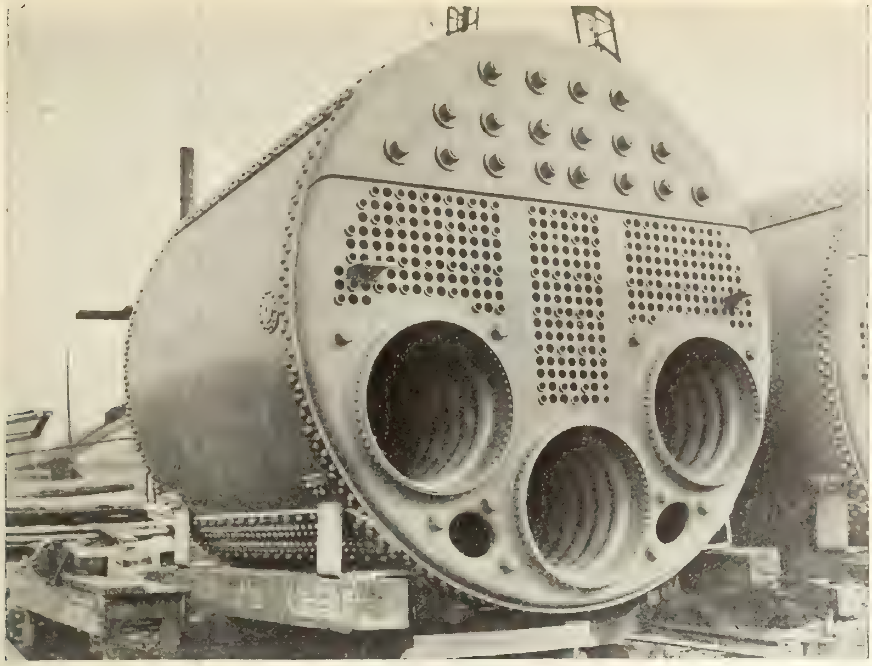






ASH AND COAL HOISTING WINCHES ABOARD-SHIP.

GENERAL VIEW OF SHIPBUILDING PLANT OF THE POLSON IRON WORKS AT TORONTO, ONT.



SINGLE-ENDED BOILERS FOR CAR FERRY "ONTARIO NO. 2," EACH 14 FT. DIA. BY 12 FT. LONG. WORKING PRESSURE 180 LBS. PER SQ. INCH. MORRISON SUSPENSION FURNACES 42 IN. INSIDE DIAMETER.

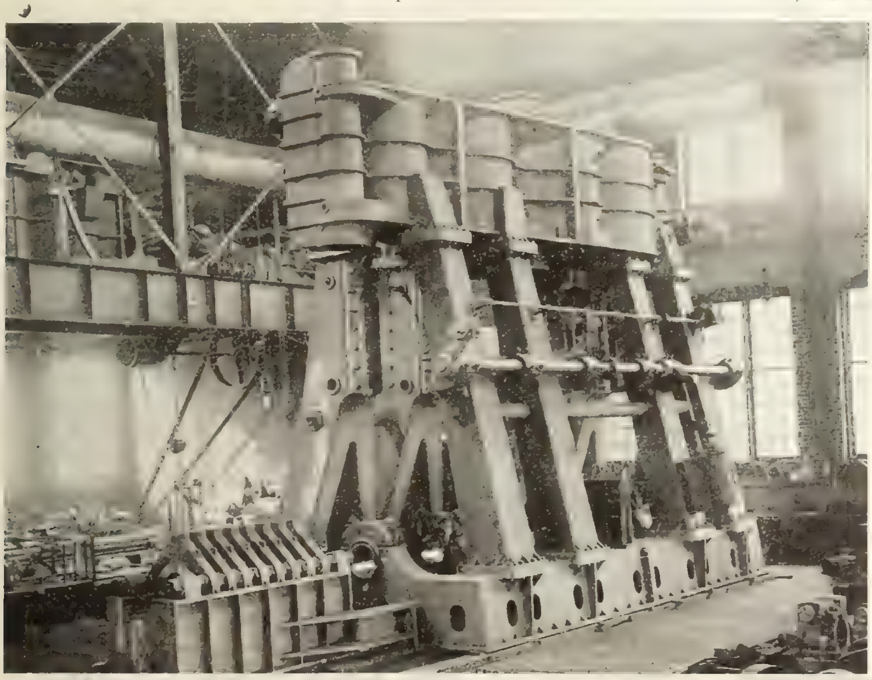
Shipbuilding Industry Auxiliaries

Shipbuilding, when the construction of high-class liners is involved, may be said to be altogether cosmopolitan, in that hardly any trade or industry may be found unassociated with it. In degree only is this less true of craft with more modest titles—tramps. Among the illustrations accompanying this article, will be found a fair representation of accessory equipment common to deep sea vessels, whether for salt or fresh water service, passenger or freight trade. The examples of vessel type—there is no lack of variety, are in every case products of Canadian shipyards, and with a few exceptions the auxiliary machinery and accessory equipment are also of Canadian manufacture. The exceptions, we may say, are representative of British manufacture, some of which have in the past found a place aboard Dominion-built ships.

CANADIAN GOVERNMENT FISHERIES PATROL BOAT "VIGILANT," 176 FT. x 22 FT. x 14 FT. 3 INS., BUILT BY POLSON IRON WORKS.

As bearing out the statement in the opening sentence of the above paragraph, shipbuilding may be said to create opportunity and broaden the scope of metal working and kindred manufacturing plants, irrespective of their being large or small. A few of the requirements follow:—Brass, iron and steel castings; ship and engine forgings, heavy and light; deck and hold stanchions; ship plate and shape mills; sheet iron and tinplate work; chain—anchor and derrick; rope—hemp, Manila, wire, for mooring and hoisting; anchors, lamps, radiators, wash basins, bath tubs, water closets, furniture and furnishings; lifeboats, lifebelts, lifebuoys, electric wiring, charts, compasses and telegraphs; hand and steam steering gears; steam and hand winches, windlasses and capstans; ash hoisting engines and ash buckets, firing tools, chequered plating, sparred gratings or grills, and hand railing; safety, stop, and throttle valves; feed check, sea suction and discharge valves; water gauge fittings, pressure and vacuum gauges, jointing material and gaskets; boiler, pipe, and cylinder lagging; directing or distributing boxes; feed, bilge, fire and deck pumps; propellers; shaft, eccentric, piston and connecting rod forgings; cylinder drain and small pet cocks; relief valves; dynamo engines and dynamos; motors; forced draft and ventilating fans and engines; oilers; chain blocks; rope blocks; copper and brass piping; indicators, indicator cocks and piping; eyebolts, shackles, clocks, galley and refrigeration equipment, ship chandlery, general, etc.

Convenience in procuring equipment as above detailed is by no means unimportant, although in the establishment of new shipbuilding plants it is not always possible to have the various trades represented within ready call. Judging from personal observation, and having the various auxiliaries and accessories enumerated in mind, such centres as Montreal, Que.; Halifax, N.S., and St. John, N.B., would be ideal for a shipbuilding and marine engineering plant installation, other conditions being

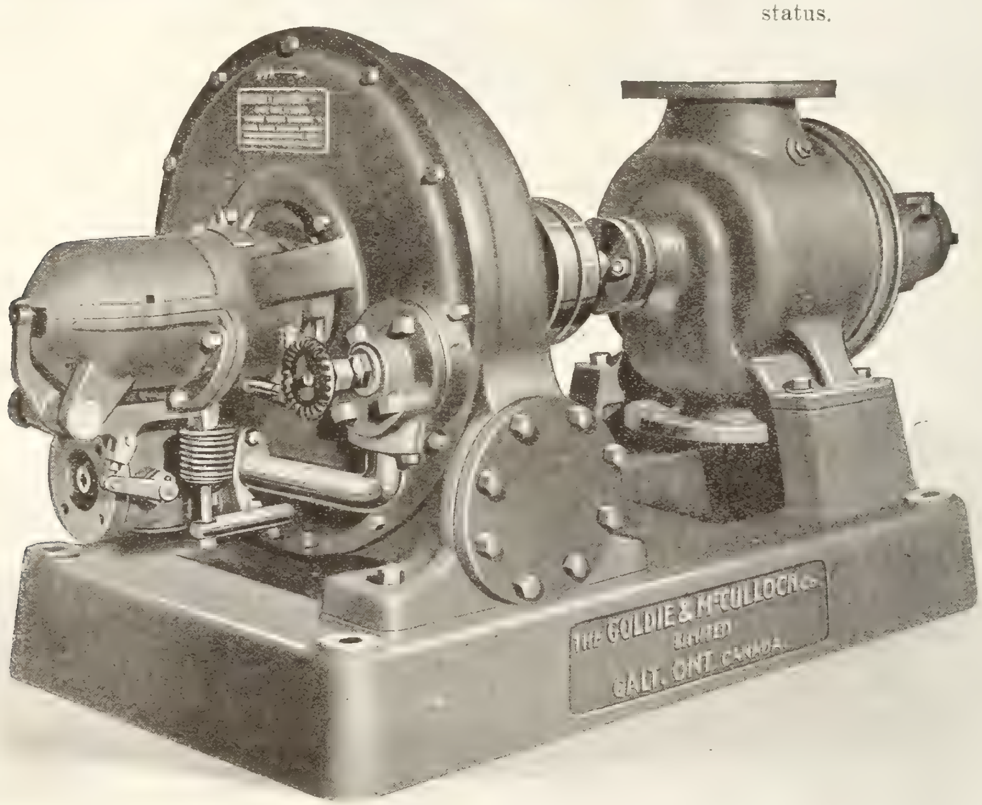


TRIPLE EXPANSION ENGINES OF THE NORTHERN NAVIGATION CO. S.S. "HAMONIC." BUILDERS THE COLLINGWOOD SHIPBUILDING CO.

GENERAL VIEW OF PLANT OF THE MONTREAL DRYDOCK CO.

by, just as well, and oftentimes more promptly than they themselves could, through lack of reasonable opportunities; the cost besides is usually less. A "way-out" from munitions making may be said to be now offering to many of our smaller machine shops and foundries, by their seeking to supplement in the lesser details, the big undertakings of our shipbuilders, and if the same keenness to get the business, and expert application is directed to its subsequent handling, as were apparent in shell manufacture, there is little doubt but that equally satisfactory returns will follow.

It has been endeavored in the foregoing to present such data as meantime may draw attention to Canada's capacity and readiness to bear a part in the restoration of her Empire shipping status.



TURBINE DRIVEN CENTRIFUGAL PUMP FOR BILGE, BALLAST OR CIRCULATING PURPOSES.

equally satisfactory, of course. In each of these cities, small engineering, blacksmithing, and foundry enterprises abound, as do also agents with warehouse accommodation for stocking standard marine supplies. A shipyard unless surrounded by quite a coterie of general providers as indicated is both isolated and handicapped, and while such a condition may be altogether beyond control, an obstacle of no mean proportions is always in evidence to restrict progress and expansion, no matter how ideal be the water front facilities.

Shipbuilders and marine engineers welcome the help arising from the outside sources enumerated, enabling as it does their concentrating on the main essentials of their various contracts, and relieving them of the necessity of doing work which can be done in a plant near-

CANADIAN GOVERNMENT HOPPER BARGE NO. 2, BUILT AT COLLINGWOOD, ONT.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

HUMOROUS SIDE TO MEDICINE AT SEA

By Capt. Geo. S. Laing.

THE healthiest place to be found is perhaps on the ocean. This can easily be attributed to the fact that ocean-swept air is comparatively dustless, and that disease germs in suspension are to a great extent absent, if not non-existent. Further, the sea's function in health avenues is to purge, renew and stimulate all land contaminated air. Africa and Australia have no desert sands that sea breezes can't visit. Brazil has no tepid jungle, whose poisons are not eventually eliminated by ocean air. In short, sea breezes and sea motions, i.e., currents, tides and waves, are the balancing agents in providing and maintaining human and plant life on our sphere.

It naturally follows that seamen on their voyages are, broadly speaking, immune from colds, coughs and aches; yet as accidents are bound to happen in such a hazardous life, the law compels every sailing ship and tramp steamer to carry a medicine chest with a regulation outfit and a book of instructions. Doctors are unknown on those vessels, so every captain acts as medical adviser or hands the job over to the mate or steward.

Seamen have apparently no right to be sick, and the "treatment" they get when off duty owing to illness would make a horse laugh. For instance, an A.B. fails to muster with the watch at midnight and the officer goes to the fo'c'sle to get an explanation.

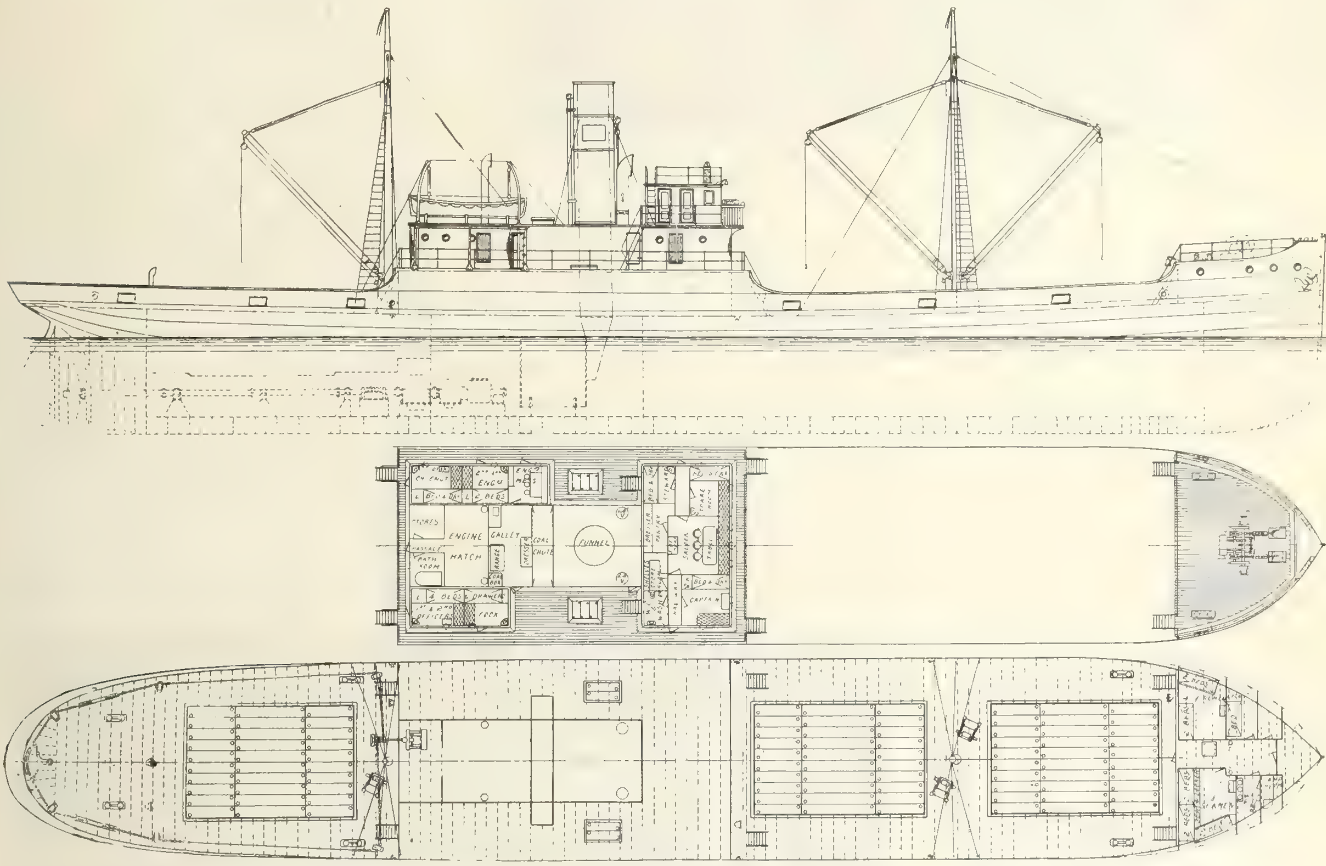
"What's the matter, Smith?"

"Pains in the back, sir."

Where ordinary mortals would get sympathy and encouragement, Jack is told that the skipper will come along after breakfast and "lance it." After perhaps 12 hours has brought mid-day along, the mate remembers to report Smith's illness to the skipper. The head of the ship is quite astounded and mumbles "sick," that's funny; what's the matter with him?" Then "tell Smith I want to see him." Mark you, the "doctor" never thinks of going to see Smith. The patient must hop into his clothes; if the weather is bad, he may have to put oilskins and sea-boots on to get along the wet decks. Poor Smith is under the suspicion of everyone and feels blue enough with the disgrace alone.

Arrived on the poop or bridge deck the skipper puts on his deep-sea frown and shouts, "Where's the pain Smith?" The A.B. goes over his ailment and is told to "come down below and get some medicine." This always takes the shape of Epsom salts, and liberal enough in quantity to serve three people. If the locality is the Cape of Good Hope or Cape Horn, Smith is reminded that "Cape fever" is not tolerated on board. This illness is supposed to be all sham to avoid the discomforts of a gale or a week or two of bad weather. As Smith had to swallow the abnormal dose of salts under official eyes, he really feels squeamish now; but is told that if he can't work within four hours the dose must be repeated.

In case the man is really sick—that means going to die—the captain orders the steward to give the suspicious one a little dainty food. There is invalid port and brandy on board, but that's for funerals and Customs officials, who sign all documents of pratique with corkscrews. The steward on those vessels has not always an enviable reputation, as he has to bear the brunt of any discrepancies in the victualling line, and often acts as the captain's confidential strategist in the sale of tobacco and clothes known as "slops." Bad bargains or short rations are always attributed to this man, and he is sometimes known as "the sneak," meaning that no one can trust him.

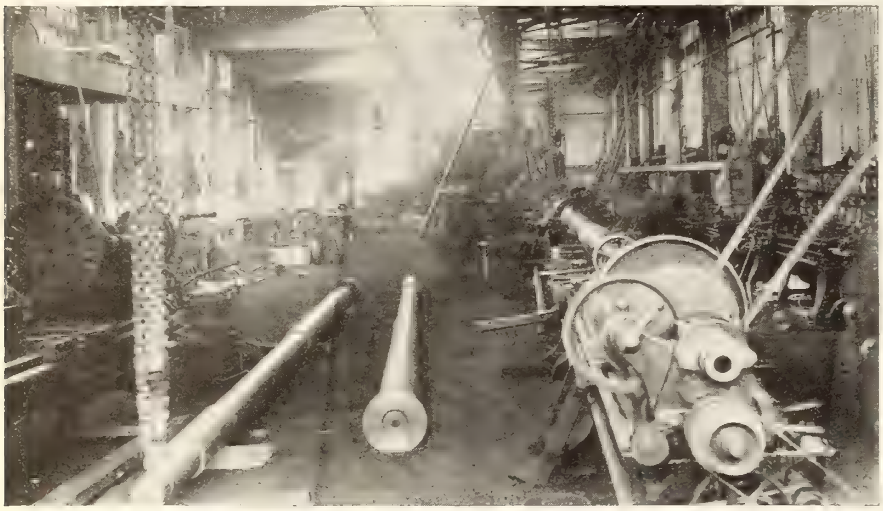


STEEL OCEAN-GOING FREIGHTER BUILDING BY NOVA SCOTIA STEEL & COAL CO., NEW GLASGOW, N.S.

At supper time when the steward is washing up in the pantry he suddenly remembers what the captain said about a little dainty food for Smith. The remains from the cabin table are scanned and a soup spoonful of blanc mange, which was left from dinner is tossed on the back of a bloater, which had graced the evening meal. To keep the bloater and blanc mange company, a forlorn meat ball is thrown into the sick man's tin, as a clean plate would make a sailor "get notions." This meat ball made from bully beef and preserved potatoes would choke an ostrich, and certainly finish a dyspeptic. With the tin of "dainty food" served a la deep-sea, the steward makes for the fo'c'sle. It will now be the second dog-watch, 6-8 p.m., and "all hands" bar the wheel and lookout men are smoking and yarning around the fo'c'sle benches.

The steward's entry causes a few caustic remarks. "It's fine to be Smith lying in a top bunk eating cabin fare." Another gibes out, "Pain; I'm so sore all over that I'm afraid to lay down, for fear the skipper measures me for a suit of canvas and gets out 'the book.'" Poor old Smith raises his head and strikes it on a bare thwart-ship beam and takes the tin from the steward. As sick sailors are not supposed to have appetites in front of their shipmates, the tin is put on a little shelf at the side of the bunk. The steward asks what report he will make to the captain, and Smith's voice is drowned by six or eight huskies shouting, "Much worse," "A little better," "Needs a stimulant," and so on. One joker actually said that if he could get "stomach poultices from the cabin table" he would lay down right away. This was in reference to Smith's tin plate.

Eight bells comes, and the watch below turn in. The "glim is doused," and soon the sleep that sea air induces is over everyone. Even Smith forgot to keep awake to eat his "dainty food." At one bell, 11-45 p.m., the mate is heard to bawl into the fo'c'sle, "Now, get a move on, boys; all hands shorten sail." Smith rolls over with the vessel's weather lurch and finds the remains of his "dainty food" among the bedclothes, for the rats have made off with most of it. In five minutes more he is hauling on the weather main clewgarnet, vowing that he will never get sick again, for the cures are worse than the disease.



TURNING UP PROPELLER SHAFTING AT THE HALL ENGINEERING WORKS, MONTREAL.

On the longest of voyages, sailors may have wet clothes and damp beds for weeks and weeks at a time, yet their general health is not affected owing to the salt water and pure air. Ordinary coughs, colds and rheumatism are unknown on the ocean. True, we have our troubles in tropical countries and develop all kinds of diseases, such as beri-beri, malaria, yellow jack, cholera, bubonic plague, etc.; but that is away from our subject of health and medicine at sea.

Deep-sea sailors have their own "home remedies," too, and Stockholm tar is used with good results on cuts, whilst tar water is taken internally for various troubles. Turpentine and coal oil are also used in different ways, and ocean water in its natural state is taken twice daily in half-pint doses as an aperient for those who may fall victims to the indigestible food that has always been a part of ocean life on long voyage craft.

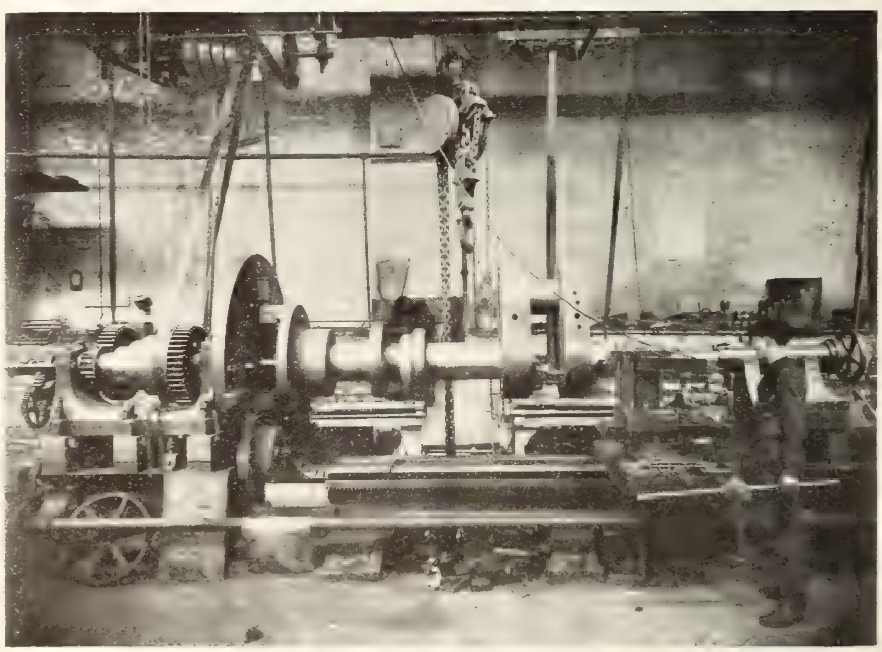
Of course, this article has no bearing whatever on Atlantic liners or immigrant and pilgrim carriers. The first mentioned could be termed floating palaces, and the other two classes are often teeming from stem to stern with all the diseases that mankind can carry around with him.

N.N. CO. S.S. "GERMANIC" BURNED

EARLY on the morning of March 30, fire broke out on the Northern Navigation Co., steamship Germanic, berthed at Collingwood, Ont., and burned the vessel to the water's edge. The origin of the fire is not known, but it appeared to have started about the engine and boiler-rooms, where the only fire on board the boat was that in a small stove used in the lower engine-room. This, it is said, was closely attended to before the workmen, who were fitting out, left at 6 o'clock the evening previous.

The Germanic was a wooden steamer, and was built in 1899, the order at the time being placed by the Great Northern Transit Co. and completed under the Northern Navigation Co., which came into existence while the steamer was in the course of construction. The boat had been plying on the route between Collingwood, Sault Ste. Marie and Mackinaw. She was 184 feet in length, 23 feet beam, and 12 feet in depth. This season the steamer was to have been again sailed by Captain F. Moles, with S. Burgess as chief engineer, both of whom have been on her for a number of years.

The Germanic is the last of the older steamers of the Northern Navigation Co. which have plied on the Georgian Bay route, the steamer City of Midland having been burned in March, 1916, and the Majestic in December, 1915.



CRANK SHAFT REPAIR AT HALL ENGINEERING WORKS, MONTREAL.

Observations on Safety Valves for Marine Boilers*

By E. F. Maas

The various elements of marine boiler safety valves which have to do with successful operation are considered. Seven typical valves are discussed and illustrated. Many suggestions of practical value for the grinding and repair of safety valves are embodied, these being the result of observations made by the author on valves under working conditions, and on repaired valves in the laboratory. The subject is pertinent to our shipbuilding revival.

THE purpose of this article is not to give a complete description of the design and working of all marine safety valves to be found on the market to-day, but to analyze some of the characteristics of the working parts of the more common types, to indicate their advantages and the difficulties experienced with them, and to point out helpful methods in repairing and improving old valves. The paper presents the results of observations made on valves under working conditions and during tests of repaired valves in the mechanical laboratory. In the case of one valve, not yet upon the market, the statements are based upon experience gained from work on other valves, and on a somewhat incomplete report of laboratory tests of this valve. This test was not witnessed by the author. Each of the seven figures gives, not a complete view of a valve, but a partial section only, this section showing such parts as come within the scope of the paper. It is assumed that the working of these safety valves is familiar to every reader, as well as the nomenclature of the valve parts. No general explanation of them, therefore, is given.

Fig. 1 represents a valve of a somewhat obsolete design probably not made by any manufacturer to-day. This type

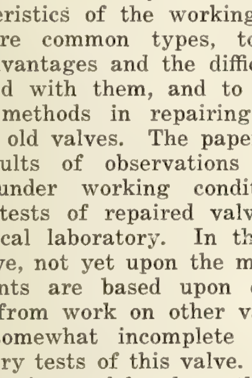


FIG. 1. OLD TYPE OF SAFETY VALVE.

is still to be found, nevertheless, in many of the older ships, and should be considered. Fig. 2 shows a later type of valve having an attachment for adjusting the blow-down, a feature indispensable in a modern marine safety valve. Fig. 3 is practically the same as Fig. 2, the main difference between the two being in the design of the blow-down adjustment. Fig. 4 represents one of the latest and most successful designs on the market at the present time. In Fig. 5 is shown a valve which has not yet fully emerged from the experimental stage, and to the knowledge of the author is not yet offered for sale as a marine safety valve. Figs. 6 and 7 show modifications made to valves of

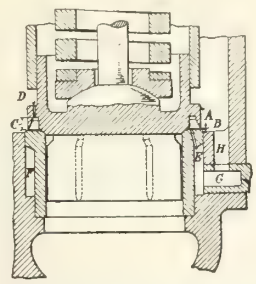


FIG. 2. LATER TYPE OF VALVE WITH ADJUSTABLE BLOW-DOWN.

the type represented by Fig. 3, these modifications having been applied during the repair of these valves in order to fit them for further service, after their original working adjustment had been destroyed through long service or neglect in maintenance. The particular features discussed in the article are:

(a)—Valve seat, flat or beveled, and its tightness.

(b)—Pop of valve, amount of simmering before pop, and height of lift.

(c)—Closure of valve and chattering at closure.

(d)—Blow-down of valve and methods of adjustment.

(e)—Discharge capacity.

(f)—Overhaul and adjustment of old valves and improvements made at slight expense.

Valve Seat

A glance at the figures will disclose two valves with flat seats (Figs. 1 and 5), the other five having beveled seats. While this might indicate that the beveled seat is the more common, the relative advantages of each type are strongly supported by manufacturers of the two types. The experience of the author has been that a flat seat is just as easy to grind-in and make tight as a beveled seat, and that the flat seat is more likely to stay tight. On account of the distortion of the valve seat which will result from a slightly uneven expansion or from spring of the material under high pressure, the tightness of a beveled seat is seriously affected, and the more so the greater the bevel, if by bevel we understand the angle between the valve seat and a plane perpendicular to the center line of the valve.

On the other hand, a flat seat will remain steam-tight even after a considerable distortion has taken place, provided that the valve has been carefully ground to its seat in the first place. It should be borne in mind that the valve and seat are in contact only along a very narrow strip, in the case of either flat or beveled seats. For equal lifts of the valves, a flat seat will give a greater discharge capacity under certain circumstances, as will be discussed later, a fact which will weigh in favor of the flat seat, for some designs, at least. It has been argued that a beveled seat, especially where the bevel is considerable, about 45 deg., will more easily rid itself of particles of scale or other foreign matter between the valve and its seat. In this connection attention should be called to the prevalent custom in marine practice of attempting to tighten the valve on its seat by turning it by means of the valve stem. Such practice usually has an effect directly opposite to that desired. A better way is to lift the valve from its seat by the easing gear and thus blow away the scale or other matter. A steeper bevel than 45 deg. is inadvisable for a steam safety valve, as the tendency for the valve to stick on its seat is too great and may produce disastrous results. It is significant that while only a few years ago most safety-valve specifications

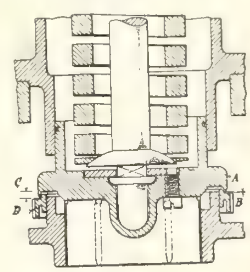


FIG. 3. MODERN SAFETY VALVE WITH ADJUSTABLE BLOW-DOWN.

called for seats beveled at an angle of 45 deg., specifications of to-day, notably those of the U. S. Navy Department and various State Boiler Rules, do not require it, indicating that a transition from 45 deg. to the flat seat seems to be under way. It is the author's opinion that such a change is for the better.

Pop of Valve

By "pop" of a safety valve is meant its instantaneous rise to almost full lift after the first tendency to move from its seat, or what is known as simmering

*From a paper presented before the American Society of Mechanical Engineers, New York, December, 1916.

has taken place. A clean-cut pop is most vitally necessary in a successful safety valve. Without pop there will be a prolonged simmering of the valve as soon as the pressure has been reached for which the valve has been set, and the unduly prolonged simmering will soon score both valve and seat, particularly if the steam is superheated, thus producing a leaky valve. The pop of the valve in Fig. 1 will be determined by the diameter of the flange A, the amount of the distance B, and, to some extent, by the shape of the surface C. It is assumed, of course, that the valve has been ground to its seat and made tight. To design a valve of this type that will give a satisfactory pop, therefore, requires previous experience regarding the relations of these three variables, otherwise some experimenting must be done. When this valve is refaced and reground, it is also of utmost importance that the original conditions of the working parts be restored. Gauges for the original shape of both valve and seat, and the proper distance between the two, should be furnished the machinist repairing the valve, otherwise a misfit is liable to result and an uneconomical valve produced. A valve of this type requires a very long spring in order to give a satisfactory lift, on account of the small overhang of the flange A over the seating surface of the valve D, which limits the available additional lifting force required after the valve has started from its seat.

In the valve in Fig. 2, the pop will depend on the diameter of the flange A, the amount of the distance B, the depth C of the main pop chamber, and the size and number of the holes D. Of these four items, A and D are determined by the manufacturer of the valve, and, if rightly proportioned in the first place, need never be changed. Items B and C are both variable, however, with the wear and refacing of the valve and seat. In this valve it is desirable to have the lip A wear down in the same proportion as the valve and seat. As this is very seldom the case, however, there arises the necessity for adjusting these features when the valve is overhauled. It should be noted that the depth of the pop chamber does not influence the pop as much as does the distance between the flange lip and the valve bushing. The former need be checked only roughly, while the distance B must be absolutely correct. An approximate value for B is 0.01 in. for the average size of marine safety valve.

The pop in Figs. 3 and 6 is decided by the three items, size of flange A, distance B and depth of pop chamber C. In these respects the valves are similar to the valve of Fig. 2, the remarks about which will apply to Figs. 3 and 6. One difference, and an important one, is that the distance B can be adjusted after the valves are assembled, by means of the blow-down ring D. Thus, it would seem as if the necessity for the very close machining of the lip A in overhauling these valves would not exist. Such is not always the case, however, as the adjustment of the distance B for a satisfactory pop may interfere with the adjustment for the desired blow-down. This will be explained in more detail later.

In the valves of Figs. 4 and 7, the pop is dependent upon the size of the flange A, the distance between flange and

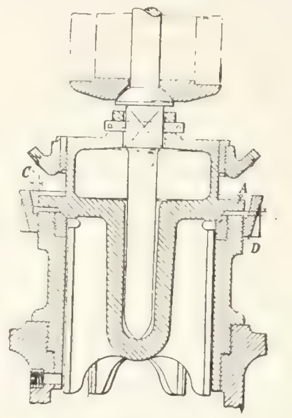


FIG. 4. RECENT TYPE OF MARINE SAFETY VALVE.

valve seat B, and the width of the ring-shaped opening at C. This difference between the two valves prevails, however, for in Fig. 4 the main deciding feature is the distance B, by reason of holding the ring area C comparatively large, whereas, in Fig. 7, the pop will be determined mainly by the distance C, which is just large enough to let the valve flange A clear the inside of the adjusting ring D. Therefore, in overhauling the valve of Fig. 4, strict attention must be paid to the distance B in order to bring it back to its original value, by means of a cut from the wider side of flange A in case either the valve or its seat have been refaced, thereby lowering the valve and decreasing the distance B. In the valve of Fig. 7 only a rough check of distance B need be made. A suitable valve for this distance in an average-size valve is 3/16 in. The width of the ring area C has been fixed once in making the valve parts, and need never be changed in overhauling this valve.

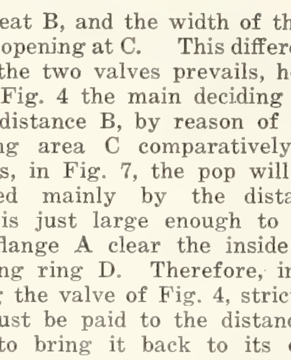


FIG. 5. EXPERIMENTAL VALVE.

In Fig. 5, the pop depends upon the distances A and C, which can be regulated by means of the adjusting rings B and D. The inner ring should be screwed very close to the valve disc, but not touching it. The outer ring furnishes the greater part of the additional lifting force required after the valve has started from its seat.

Simmering

The reduction to a minimum of the period of simmering before lift, which is very essential to the successful working of any safety valve and to the length of its useful life, can easily be accomplished in all the valves of Figs. 3 to 7 if the proper care is exercised. In the valves of Figs. 1 and 2, as previously pointed out, the reduction of the simmering is mainly a question of design and original adjustment, unalterable after the valve has been set up.

Lift

It is known that all safety valves will give their highest lift at popping, the sustained lift being less than this by from 10 to 25 per cent.. The average lift of a 3-in. or 4-in. valve is about 1/8 in. To increase this lift without interfering with the blow-down or resorting to abnormally long springs is a difficult matter. In order to obtain the maximum lift, the valve spring should be made to contain as many turns as possible within the space available for it.

Closure

In order to prolong the life of a safety valve, it is necessary that its closure be accomplished with the minimum amount of shock. When a valve comes down on its seat each time with a heavy blow, both valve and seat will soon be distorted, and the valve will start to leak. For obtaining a large discharge capacity, a high lift is desirable, but this becomes a detriment if the closure is accompanied by shock. In this respect a valve with a beveled seat is generally inferior to the one with a flat seat, as the flat seat affords more of an opportunity for the steam to form a cushion at the moment of closure. Especially is this the case with the valve shown in Fig. 5, there being an excellent steam cushion between the valve disc and the inner ring B for checking the descent of the valve. Another valve which seems to give an easy closure, although having a 45-deg. beveled seat, is the one shown in Fig. 7. It is to be regretted that on neither of these valves are there available data on the length of their useful service without repairs upon which to base a more reliable conclusion regarding this feature of the valve closure. As previously mentioned, both of these are new types of valves and not yet fully tested out in service. The tendency of a valve to chatter at closure is generally caused by too small a blow-down.

Blow-down

For adjusting the blow-down, or difference in steam pressure under the valve at popping and at closure, there are two different systems represented in the valves shown. Before analyzing these two systems, it should be mentioned that in the valve of Fig. 1 there is no adjustment of the blow-down. In this valve, therefore, the amount of blow-down desired will have to be decided on in advance, by previous experience from similar valves, proportioning the

valve flange and the spring as well as the shapes of valve and seat so as to give the desired blow-down.

The arrangement in the valve of Fig. 2 for adjusting the blow-down is one probably familiar to most steam engineers. When this valve discharges, part of the steam passes through the holes E drilled in the bushing and into the chamber F, generally termed the secondary pop chamber, but more properly called the blow-down chamber. The only exit from this chamber is through the bushing G and the passage H communicating with the discharge space of the valve casing. By turning the bushing G and locking it in different positions, the size of this exit passage for the steam can be restricted, thereby limiting the amount of steam passing through the holes E, and so regulating the pressure under the valve lip A. Of course, the holes D in the valve flange will have a similar influence on the blow-down. The size and number of these holes are generally proportioned for a minimum blow-down of, say, 4 lbs. A smaller blow-down than this should not be attempted in any safety valve as it only shortens the life of the valve and produces a tendency to chattering, as previously mentioned, with no additional advantages in the working of the valve.

In all of the valves of Figs. 3 to 7, the adjustment of the blow-down is accomplished by means of the adjusting rings D. Screwing these rings up will increase the blow-down and screwing them down decreases it. The shapes of these rings should be noticed. The rings of Figs. 4 and 5 are especially adapted to give a minimum obstruction to the flow of steam and so increase the discharge capacity of the valve, both being excellent shapes. It has been especially claimed for the ring of Fig. 5 that in conjunction with the lower ring B it has the effect of reducing the lifting force at very low lifts and increasing it as the lift increases. This is a most desirable feature in any safety valve.

The ring D of Fig. 7 has been designed and tried out as an improvement on valves of the type shown in Figs. 3 and 6. It has already been pointed out that in these valves the main feature determining the pop is the distance B, also that the position of the ring D will determine the amount of the blow-down. Thus it will be seen that there are two factors to be considered in determining the proper position of these adjusting rings, and that each of these factors may require a different setting of the ring. In such a case it is necessary to take out the valve disc and machine its lip A until the proper distance of this lip over the adjusting ring is obtained, after first determining the position of the adjusting ring for the desired blow-down. This procedure involves tedious trials.

Where gauges for finishing the valve disc and adjusting ring are furnished by the manufacturer of the valve, it is comparatively easy matter to machine these parts when making repairs. When the time comes, however, to overhaul the valve, it is generally found that all gauges are lost or unavailable. In order to eliminate the tedious machine work in overhauling and adjusting valves like those in Figs. 3 and 6, the modifications as shown in Fig. 7 were devised. The lip of the valve disc has

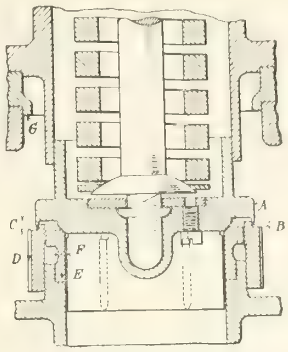


FIG. 6. MODIFIED SAFETY VALVE OF TYPE 3.

been cut away and the diameter of flange slightly reduced. The shape of the blow-down ring has been changed entirely, as shown, and made somewhat similar to the one in Fig. 4. The different action of the two rings D in Figs. 4 and 7 as regards popping has already been explained. The main feature in the ring of Fig. 7 determining the blow-down is the angle E. This angle, 36 deg., 30 min., has been found to give a range of blow-down of from 4 to 9 lbs. The laboratory tests on the popping and blow-down of this improved valve have given very good results.

Discharge Capacity

It is well known that when steam under pressure is allowed to flow through an opening, the maximum discharge will be obtained when the lower pressure is equal to or less than 58 per cent. of the higher pressure. When such conditions obtain, the pressure at the throat section, or most contracted part of the chan-

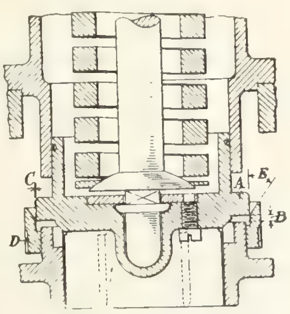


FIG. 7. ANOTHER MODIFIED VALVE OF TYPE 3.

nel through which the steam is flowing, will be 58 per cent. of the higher pressure, regardless of how much the pressure in the discharge chamber will fall below this value. The weight of steam discharged can then be calculated from Napier's formula: Flow in pounds per second = absolute pressure $\times$ area in square inches $\div$ 70. If this is applied to the safety valves shown in Figs. 1 to 7, it will be found that the valves of Figs. 1, 2, 4, 5, and 7 undoubtedly will have their throat section at the inner circumference of the valve seat. Therefore, the area of opening at this section will determine the discharge capacity of the valve, provided the resistance to the flow is not made great enough to raise the pressure in the valve casing above 58 per cent. of the pressure under the valve seat. Making allowances for reductions of the free opening over the valve seat caused by guide wings, the following approximate formulæ, as given by some manufacturers, are obtained for calculating the discharge capacity:

$W = 149$ lpd for a flat seat

$W = 105$ lpd. for a 45-deg. seat

where W = discharge in pounds per hour

l = lift of valve in inches

p = absolute pressure under valve, lb. per sq. in.

d = diameter of valve seat in inches.

For equal lifts, then, the flat seat will give a greater discharge than the 45-deg. seat, which is obvious when it is considered how the 45-deg. seat restricts the throat section of the valve as compared to the flat seat. It should be mentioned here that the discharge capacity will be influenced to some extent by the smoothness of the approach to the throat section. On this account, the valve of Fig. 5 should give an exceptionally good discharge capacity, which seems to be borne out by the meagre test figures available. With valves of the shape shown in Figs. 3 and 6, it is frequently found that the actual discharge capacity will fall considerably below that obtained by the above calculations. This, no doubt, can be accounted for by the throttling of the discharge channel under the valve lips, especially at the lower lifts.

Repair and Adjustment

Bearing in mind that a safety valve, to be successful and satisfactory, must not have too delicate an adjustment nor require too frequent overhauling, it seems advisable to alter the valve in Fig. 3 to the type shown in Fig. 7, where repeated attempts at obtaining satisfactory operation of the old type have failed. Such alteration can be accomplished easily and cheaply, as the only new part to be made is the adjusting ring D, and the only part to be machined is the valve disk. The result will be an exceptionally rugged valve having no delicate parts, and one which can be easily overhauled and adjusted without expert assistance.

Grinding

For grinding a valve to its seat the most satisfactory grinding material is powdered glass and machine oil. It is easiest and most expedient to grind a valve cold, and this will in most cases produce entirely satisfactory results. Only where repeated efforts at making a valve tight by these methods have failed, should hot grinding be attempted. The hot grinding is a trying performance to any workman, and will only be an approximation to actual working conditions in any event, as a grinding at the actual temperature under which a safety

valve operates is out of the question. Where all other methods have failed to produce a tight valve, the design shown in Fig. 6 will sometimes serve. By inserting the raised seat E and taking care to machine this so that its weakest section F will be between the old valve seat and the new, there is an opportunity for this raised seat to adjust itself to the valve, regardless of what expansions and contractions may be taking place in the metal of the old valve seat. Frequently this will produce a tight valve. The construction shown in Fig. 6 is an improvement on the valve shown in Fig. 3, but the same, or a similar design, can be applied equally well to most other types. In making this alteration to a valve it is necessary to have a new valve seat E and adjusting ring D, and to insert a distance piece G under the valve bonnet in order to raise the bonnet the same amount the valve has been raised from its former seat. The author has seen this method applied frequently and with great success.

Another point, often misunderstood in repairing a safety valve, is the amount of clearance to give to the guide wings under the valve disk in the valve bore. No attempt at a very close fit of these parts should be made, as such would only increase the chances of the valve sticking. A suitable clearance for a 4½-in. valve bore is 1-32 in. on the diameter, or 1-64 in. on each side.

FIRST BRITISH VESSEL LAUNCHED IN UNITED STATES

WHAT is said to be the first British steamship ever launched in the United States was sent down the ways on Saturday, April 7, at the Staten Island, and was christened the War Captain. It also was the first large steamship ever constructed on Staten Island.

Miss Gertrude Davidson, fourteen years old, granddaughter of W. J. Davidson, president of the Shipbuilding Company, acted as sponsor for the new vessel. In the presence of a large, cheering crowd, she broke a bottle of champagne on the steamship's hull as she slid down into the water. British and American flags floated above the vessel.

The War Captain is 274 feet long, 42 feet beam and 24 feet deep, and has a capacity of 3,500 tons gross and 2,200 tons net. She is owned by the Cunard Line, and will be used as a freight ship. It is expected that she will be in commission within two months.

CONTRACTS FOR SUBMARINE CHASERS

THE U. S. Navy Department is in the market for 110-ft. patrol boats or submarine chasers. The original estimate was for 2,000 of these craft, but until recently considerably less than one-fourth that number have been contracted for. The Navy Department declines to make public the names of the contractors or the amounts of the successful bids. While these boats are being constructed, preparations are being rapidly made to take into the service a large fleet of small privately-owned motor-craft designed for inshore patrol work.

The Department has perfected plans for the expenditure of the emergency appropriation of $115,000,000 carried by the naval bill for speeding up construction of warships, and the allotment of $18,000,000 for the equipment of navy yards with additional building facilities. The bulk of the emergency fund will be used in paying for torpedo boat destroyers ordered by the Department in addition to those authorized by Congress, and for the big fleet of submarine chasers required for a coast patrol. Several million dollars will also be expended in the purchase and construction of aircraft.

APPEAL FROM ADMIRALTY COURT

COUNSEL on behalf of the Canadian Pacific Railway Co., has we understand, inscribed an appeal to the Supreme Court against the judgment of the Admiralty Court in which Mr. Justice MacLennan, on March 17 last, held that the maritime laws of England govern in respect to claims for damages suffered through the wreck of the Empress of Ireland after collision with the steamer Storstad.

Under this ruling claimants for loss of life will have preference over claimants for material loss. Life claimants seek over $3,000,000 and the total amount available for distribution is less than $175,000. Thus the C.P.R., owners of the wrecked Empress, whose claim is for $2,500,000, will not be able to recover one cent, according to Mr. Justice McLennan's ruling. It is on a plea that the distribution ought to be made under the Canadian rule, namely, pro rata amongst all claimants, that the present appeal has been entered. Argument will take place at Ottawa in May next.

EXPLOSIONS IN BOILER FURNACES

AS the gases rising from the fuel bed contain 20 to 32 per cent. of combustible gases, it is not difficult to understand that under the right conditions an explosive mixture can be formed that might cause an explosion violent enough to injure the fireman. An explosive mixture can be formed in a boiler furnace in either of the two following ways:

1—With a tight setting and the fire doors completely shut so that no air is entering above the fuel bed, the furnace and the setting are filled with a combustible gas. If then the fire doors are suddenly opened a large volume of air is admitted into the furnace and mixes rapidly with the combustible gas. Under such conditions the combustion of the gases may be so rapid that it assumes the violence of an explosion.

2—With the fire doors wide open, the furnace and the setting fill with air. If then a shovelful of slacky coal is spread over the fuel bed and the fire doors are quickly closed, the large volume of combustible gas rising from the freshly fired coal forms an explosive mixture with the air in the setting. An explosion may follow which is strong enough to blow the fire door open and even lift the hood noticeably from its seat on the setting.

COMBUSTION IN HAND-FIRED FURNACES

THE fuel in most types of furnaces acts primarily as a gas producer. With a 6-inch fuel bed the oxygen in the air rising through the grate is all used up in combustion in the first 4 inches from the grate. At a distance of 4 inches from the grate the carbon dioxide content of the gases has reached or passed a maximum of 10 to 16 per cent. and begins to drop. At the surface of the fuel bed the gases contain no oxygen, only 6 to 8 per cent. of carbon dioxide and 20 to 32 per cent. of combustible gases. The composition of the gases is practically independent of the rate of air supply. The larger the quantity of air forced through the fuel bed, the faster the fuel burns or gasifies, but the ratio between weight of air supplied and weight of fuel burned remains constant at about 7 to 1. In general the temperature in the fuel bed is the highest at 3 to 5 inches from the grate, which is also the point of maximum carbon dioxide content.

Fuel Bed Thickness

As most of the oxygen is consumed in the first 4 inches of the fuel bed, it is not necessary with the ordinary rates of combustion to run a fuel bed thicker than 4 to 6 inches in order to obtain a high carbon dioxide and a low oxygen content in the flue gases. The rate of combustion or gasification of coal depends on the amount of air that can be passed through the fuel bed. The thicker the fuel bed the higher is its resistance to flow of air through it and the less air can be passed through with a given chimney draft. A thick fuel bed, therefore, reduces the rate of combustion and thus reduces the capacity of the boiler.

A thick fuel bed is further undesirable because it increases the tendency of the coal to form troublesome clinker. Perhaps the only apparently defendable excuse for carrying a thick fuel bed is the fact that the chances of burning holes in the fuel bed are reduced. A skillful fireman avoids holes in the fuel bed by firing frequently and placing coal on the thin spots. A claim that fuel beds can not be kept in good condition if carried thin is a confession of neglect and lack of skill. A fuel bed is understood to be only the layer of incandescent and freshly fired fuel and does not include the layer of dead ashes and clinker on the grate. The ash fuses in the upper layers of the fuel bed, and as it sinks it solidifies 2 to 4 inches from the grate.

As at the surface of the fuel bed the gases contain 20 to 32 per cent. combustible gas and practically no free oxygen, to obtain complete combustion additional air must be introduced over the fuel bed. This statement is true of all the fuels, including coke, tested by the Bureau of Mines, Washington, D.C. As a general statement, about one-half of the 15 pounds of air used to burn 1 pound of coal in a boiler furnace is supplied through the fuel bed; the other half must be supplied over the fuel bed.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

GEARED TURBINES FOR CARGO AND PASSENGER BOAOTS

THE saving in weight, fuel, and expense of upkeep, including attendance, achieved by the use of geared steam turbines for ship propulsion is becoming generally recognized. Over 200 power units of this type are at present under contract or construction on this continent. We are informed by the De Laval Steam Turbine Co., of Trenton, N.J., to whom the accompanying photographs are due, that over 150,000 horse-power of geared marine turbines and gears for 500,000 horse-power altogether are now going through its shops alone.

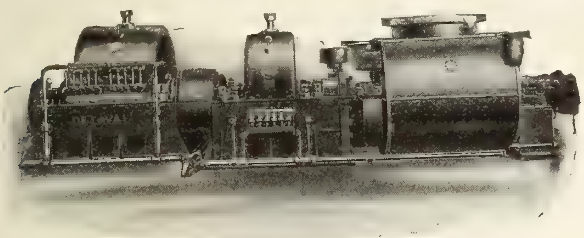


FIG. 1. UNIT OF 1500 HORSE-POWER.

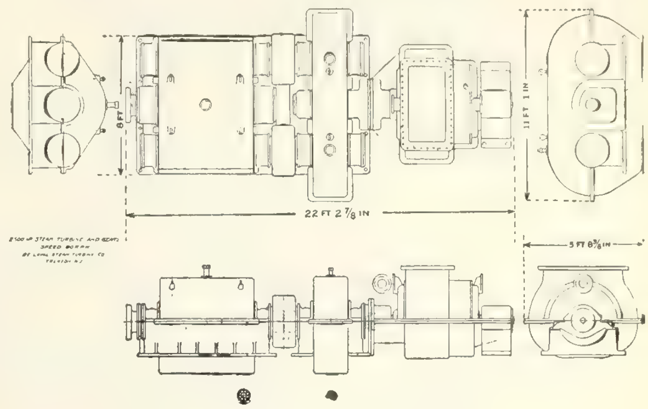


FIG. 2. UNIT OF 2500 HORSE-POWER.

The weight of a geared marine turbine, including valves, coupling, etc., is only 40 to 50 lb. per shaft horse-power, as against twice that weight for a reciprocating engine. The saving in space will be apparent from the illustrations. Fig. 1 shows a unit rated at 1,500 horse-power. The turbine is designed to use steam at 180 to 200 lb. pressure, exhausting to 28 in. vacuum, and consists of one velocity-stage wheel and seven pressure stages with separate reversing element. The reversing wheels are capable of developing 60 per cent. of the forward torque. The normal turbine speed is 4,000 r.p.m., and the propeller speed 90 r.p.m.

The complete unit, as shown, weighs only about 65,000 lbs., and occupies a space of 21 ft. long by 9 ft. wide, and 8 ft. 8 in. high, that is 1,640 cubic feet, or equivalent to about 1.1 horse-power per cubic foot. The De Laval geared turbine unit shown in Fig. 2 is rated at 2,500 horse-power, but is only about a foot and a half longer and two feet wider, and one and a half feet less in height, so that it occupies altogether about 1,773 cubic feet, giving 1.41 horse-power per cubic foot.

A saving of 10 to 20 per cent. is made in fuel by the geared turbine over the reciprocating engine drive even in the largest vessels. As compared with the reciprocating engine, the steam turbine gives a better overall plant efficiency, due principally to two factors. One of these is its ability to utilize higher superheat and vacuum than can reciprocating engines. The gain in turbine efficiency from superheat is about 1 per cent. for each 10° F., and from vacuum about 8 per cent. between 28 and 29 in., referred to a 30 in. barometer. The reciprocating engine on the other hand experiences difficulty with high superheats, and benefits little from any increase of vacuum above 28 in., because of the limited size of the low pressure cylinder and of the valve ports. In fact, too high a vacuum results in loss from the low temperature of the condensate.

The geared turbine set shown in Fig. 3 is designed to use steam at 265 lbs. pressure and 130° F. superheat, exhausting to a minimum of 28 in. vacuum. The turbine is of the compound type—that is, arranged on two shafts. This type of turbine is supplied where the highest efficiency is desired. It also gives the advantage of duplicate turbines in case of accident. The gears are of the standard De Laval type, with rigid casings to hold the pinion and gear shafts in fixed and permanent alignment. The turbines run at 2,400 r.p.m., and the speed of the gears and of the propellers is 110 r.p.m. The boats in which the units are to be installed are 480 ft. long, 60 ft. moulded breadth, 12,500 tons dead-weight, twin-screw, and are designed for a speed of 14 knots.

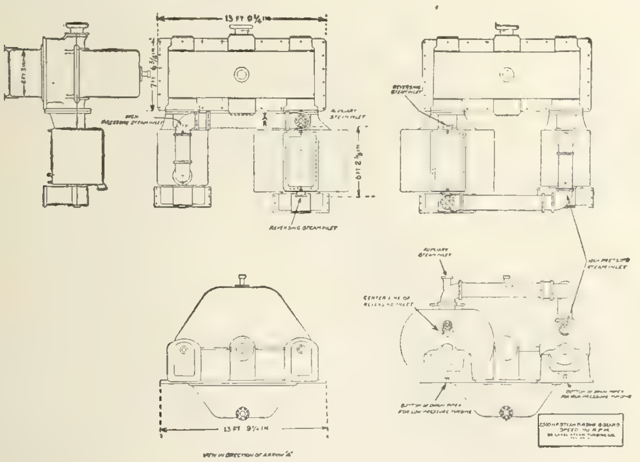


FIG. 3. COMPOUND TWO-SHAFT UNIT.

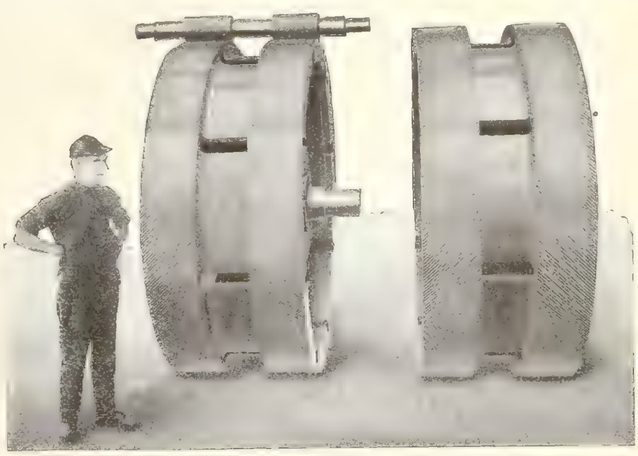


FIG. 4. TYPICAL STEAM TURBINE GEARS.

Further fuel economies are realized in turbine vessels by properly co-relating the auxiliaries with the main unit. The steam consumption of auxiliaries sometimes exceeds 15 per cent. of the total amount of steam produced by the boilers, even when running at full power, and in the majority of ships exceeds the amount of steam which can be used for feed heating. By diverting the surplus or excess auxiliary exhaust to an intermediate

stage of the main turbine, this steam can be made to produce in the latter at least half as much power as it would have produced had it been received directly from the boiler. In reciprocating engine power plants, on the other hand, surplus auxiliary exhaust is frequently bled directly to the condenser in order to save the condensate, but with a total loss of the heat of the steam. Even where it is led to the intermediate receiver of a reciprocating engine, it cannot be used with much more than half the benefit gained by introducing it into an intermediate stage of a steam turbine.

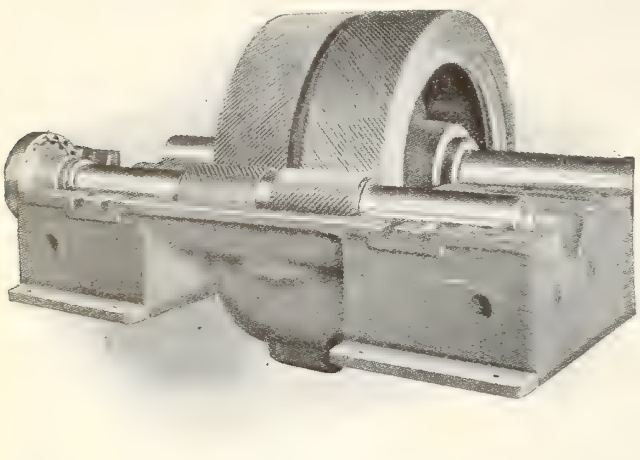


FIG. 5. TYPICAL STEAM TURBINE GEARS AND HOUSING.

Economy Feature

The economy of the steam turbine is better maintained in service than is that of the reciprocating engine, as there are fewer parts to deteriorate and cause loss of efficiency. The turbine also shows a saving in operating expense, due to the fewer moving parts, and the ease with which they are lubricated and adjusted. The oiling system is automatic and much simpler than the oiling system of a reciprocating engine.

There is little need of constant attention and frequent overhauling, such as the reboring of cylinders, refitting of valves and piston rings, and adjustment of complicated valve gear. There are no packings, except the simple ones about the shaft. The consumption of oil is trifling in comparison with that of a reciprocating plant, and there is no expense to correspond to the cylinder oil required by the latter. This fact is also of significance as regards the operation, the working parts and generally greater simplicity of the geared turbine as compared with other prime movers naturally leads to less expense for personnel in the engine room—that is, fewer oilers, machinists and men for general attendance and repair work are required.

The present controversy over electric versus geared drive for battleships and battle cruisers lends interest to the two gears shown in Fig. 4. These were cut in the shops of the De Laval Steam Turbine Co., and are to be used in the U. S. battleship "Idaho," now under construction by the New York Shipbuilding Co.

SHIP TIMBERS BAND SAW

THE revival of wooden shipbuilding has created a demand for numerous items of equipment possessing more or less novel features of construction, and the machine shown in the engraving herewith has been designed and built by J. A. Fay & Egan Co., Cincinnati, O., for the purpose of working the extra large timbers required in the construction of ocean-going vessels.

This machine is designed for extra heavy band sawing, both straight and curved, and, while particularly applicable to shipwork, can also be used to advantage in railroad and bridge shops, heavy vehicle work, and lumber mills. It saws to any angle in a full semi-circle, the wheels being carried on a housing mounted on roller bearings and angling 45 deg. to right or left by power, with hand-wheel adjustment for extremely fine setting.

The column is a single casting of ample weight with broad floor bases which enable it to carry the wheels at any angle without vibration. An auxiliary column at the rear carries the angling mechanism, and the face of the main column is planed and fitted with roller bearings to carry saw carriages, guides, etc. The table measures 48 in. x 48 in. and is all iron, and mounted perfectly rigid on main column and always level.

The wheels are 48 in. dia. x 3 in. face, and carry blades up to 3½ in. wide. They are steel spoked with laminated wood rims, faced with rubber, and are mounted in self-aligning ball bearings. Both wheels are mounted on a heavy circular carriage, gibbed to the main frame and traveling on self-lubricating roller bearings mounted in main column, making angling adjustment quick, easy and extremely close. The wheels move simultaneously, and are so located in relation to the carriage that the blade angles from the point where it passes through the table.

Driving gear is provided with automatic take-up to maintain proper tension on belt at any angle. A 15 horse-power motor at 1,500 to 1,800 rev. per min. can be belted to main driving pulley, or if at 350 rev. per min. can be direct coupled to drive shaft.

BRITISH BOARD OF TRADE AND BOAT-RELEASING GEAR

THE following important instructions to surveyors have been issued by the Marine Department of the Board of Trade as to boat's disengaging gears:—

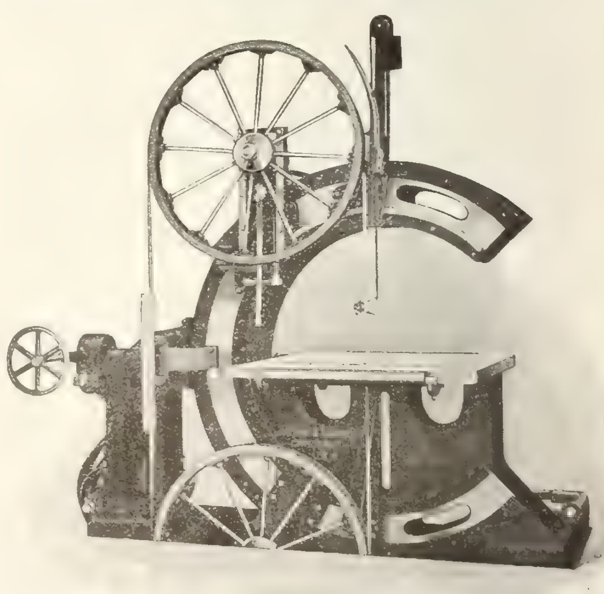
1.—When inspecting a ship's boats, the surveyors are to see that all the requirements of the Life-Saving Appliances Rules regarding means for speedily detaching the boats from the falls are complied with.

The following two clauses are extracts from General Rule 13 of the Life-saving Appliances Rules, 1914:—

2.—The davits, falls, blocks, and all other gear required for lowering the boats, shall be of sufficient strength to the satisfaction of the Board of Trade; in the case of foreign-going passenger steamers launched on or after the 1st March, 1913, they shall be of such strength that the boats can be lowered safely with the full complement of persons and equipment, the ship being assumed to have a list of 15 degrees.

5.—Means shall be provided for speedily, but not necessarily simultaneously or automatically, detaching the boats from the falls; the boats placed under davits shall be attached to the falls and kept ready for service; the points of attachment of the boats to the falls shall be sufficiently away from the ends of the boats to ensure their being easily swung clear of the davits; the boats' chocks shall be of such construction and arrangement as shall be satisfactory to the Board of Trade.

II.—Disengaging gears are not required for compliance with the Rules—It is not necessary for compliance with the Rules, that boats shall be fitted with disengaging gears when proper means are provided for detaching each fall by hand. In order to provide for speedily detaching the falls by hand when the boat is waterborne, all lower fall blocks are to be fitted with a suitable ring or long link for attachment to the sling hooks fitted in the boat, unless some ap-



BAND SAW WITH ANGULAR ADJUSTMENT FOR CUTTING SHIPS TIMBER.

proved form of disengaging gear is adopted. The sling hooks are to look towards the midship part of the boat. The eye on the block and the ring or link are to conform to the standard of strength indicated in Section III. (10) of these instructions.

III.—General conditions of approval of disengaging gears. — If disengaging gears are fitted they must comply with the following conditions and receive the Board's approval before being used as part of the statutory equipment of a ship.

1.—All disengaging gears must be so arranged as to ensure simultaneous release of both ends of the boat.

2.—The means of affecting release must be placed aft so as to be under the personal control of the coxswain in charge of the boat.

3.—The gear may be of a type affording release before the boat is waterborne, as well as when the boat is wholly or partially waterborne, or alternatively, it may be of a type affording release only when the boat is wholly or partially waterborne. In either case it must be safe, speedy, and reliable in action.

4.—The action should be such that the hook offers no resistance to release should there be a towing strain on the falls.

5.—The hooks must be suitable for instant unhooking by hand.

6.—The gear and mechanism for effecting release must be such, and so arranged as to ensure the safety of the boat independently of any "safety pins."

7.—The means for effecting release may be by hauling on, or letting go, a line, or by a lever. If release is effected by a pull upon a line the latter must be properly cased in. Rods or other connections between hooks must also be cased in whenever this is necessary for safety or for the efficient action of the gear and the protection of persons, from injury. The fairleads must be properly arranged to prevent the line, which should be fitted with chains where necessary for efficiency, from jamming or nipping, and must be strongly attached to permanent parts of the boat.

8.—Such parts of the gear as would otherwise be likely to set fast by rust or corrosion must be made of non-corrodible metal.

9.—No part of the gear, taking the weight of the boat, is to be made of cast metal.

10.—The scantlings and proportions of all parts, taking the weight of the boat, should be such as to provide a factor of safety of at least four with a dead working load equivalent to the total weight of boat equipment and full complement of persons.

IV.—Existing disengaging gears:—

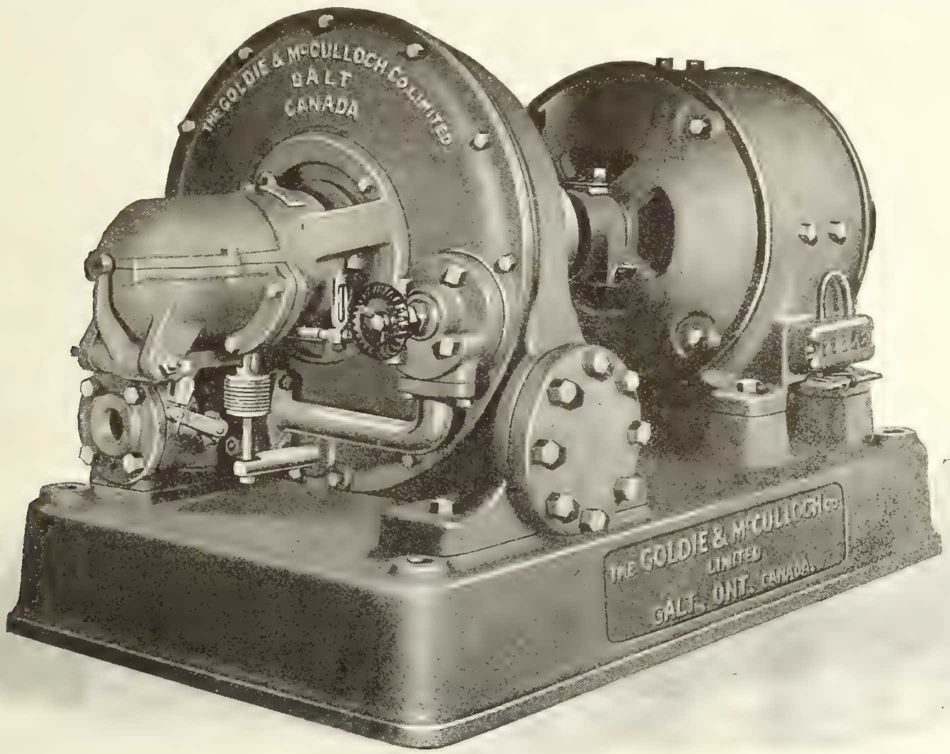
1.—All disengaging gears at present fitted in passenger ships should be carefully examined, and one or two sets of each type in the ship should be tested for strength and efficiency. If possible this should be done at the next annual survey after the issue of these instructions; but if this is not practicable the surveyor should arrange with the owners for the examination and tests to be carried out as soon as possible thereafter, and within a definite period, which should be fixed in each case.

2.—After the above tests have been made and reported upon it is intended that similar action shall be taken with regard to the disengaging gears in non-passenger vessels; but, in the meantime, they need not be subjected to tests unless an application for the same is made by a shipowner or the surveyors have reason to doubt their efficiency.

3.—Tests should be carried out as follows:—The largest boat in which each type of disengaging gear is fitted should be selected and the gear should first be tested for strength. In the case of foreign-going steamers launched before 1st March 1913, this is to be done by loading the boat with weights up to the greatest load which the davits and the lowering gear are fit to carry; if possible, the weights should be equivalent to the equipment and full complement of persons at 165 lbs. per person. In the case of foreign-going steamers launched on or after 1st March, 1913, the full test load is to be applied. The davits, hooks, bolts, locking gear and all parts that bear the weight of the boat should be carefully examined for deflection and defects. The strength test should be made with the davits turned inboard, and the loaded boat should afterwards be lowered and the efficiency of the disengaging gear tested.

A complete report of the tests should be forwarded to the principal ship surveyor, stating the dimensions of the boat, its total weight as tested, and the pattern number of the gear, or other particulars for identification. An engineer as well as a ship surveyor should, whenever possible, be present at the strength test, and a nautical surveyor at the efficiency tests.

4.—The continued acceptance of the gear will depend upon the results of the tests and upon the fulfilment of the con-



TURBINE-DRIVEN SHIP LIGHTING SET.

ditions specified in section III of these instructions.

V.—New sets of disengaging gear:—

1.—All new sets of disengaging gear, including those of types approved before the date of these instructions, must comply with the conditions specified in section III, whether they are fitted in new or in old boats. A sample gear of each size submitted should be subjected to a proof test equivalent to the total weight, including equipment and full complement of persons, of the largest boat for which it is claimed the gear is suitable.

The test should be continued to the point of fracture in order to determine the approximate factor of safety.

2.—Lowering and disengaging tests with a loaded boat are also to be carried out in the presence, when practicable, of three surveyors, a ship, an engineer, and a nautical surveyor. The trials should include tests made under the following conditions:—

(a)—Boat fully waterborne.

(b)—Boat partially waterborne, one end being out of the water.

(c)—In the case of gear which can be released before the boat is waterborne, additional tests with the keel of the boat just clear of the water.

(d)—The efficiency of the hooks and gear should also be tested by well jerking the boat in the tests (b) and (c).

3.—The acceptance of the gear will depend upon the results of the tests and upon the fulfillment of the conditions specified in section III.

4.—New sets of gear manufactured in accordance with a certificate of approval issued after the date of these instructions (see section VI.) will not be required to be tested in the manner specified in paragraph 2 of this section before acceptance, unless the surveyor has reason to doubt the efficiency of a particular set of gear. Surveyors should, however, satisfy themselves that such gears comply in all respects with the specification attached to the certificate, and one or two sets of each size should occasionally be tested to the proof load in the manner indicated in paragraph 1 of this section.

THE THRUST BLOCK

IN propelling a ship through the water, the propeller exerts a certain thrust on the water astern of the ship, and, of course, by Newton's Third Law, the water exerts an equal and opposite thrust on the propeller. This thrust is transmitted along the line of shafting to the engines. In an ordinary reciprocating engine, the thrust would have to be taken up by the crank webs bearing against the main bearings unless other means were taken to receive this. To effect this, a thrust shaft and block is placed between the engines and the propeller. In smaller engines the thrust shaft is made integral with the crank shaft, but this is unsatisfactory, and is very rarely carried out. The method that is almost universal now is to make a separate thrust shaft, and place it just aft of the crank shaft. The thrust shaft must, of course, be designed to take the necessary torque exerted by the propeller as well as to take up the thrust. The diameter of the shaft is found from Lloyd's or Bureau Veritas rules, and is usually the same size as, or a little smaller than the diameter of the crank shaft. It is also a little larger than those of the tunnel shafts, as if the thrust shaft breaks between any of its collars, it makes a repair somewhat difficult.

Number of Collars

One of the first considerations is the number of collars to be employed to take up the thrust. Obviously, large collars will be less complicated, since there is a certain definite area to be used to take the thrust, and hence very few collars need be used if each is large. There are, however, several disadvantages to large collars. Forging is made difficult, and also, with a large diameter, the inside of the shaft may contain flaws. Again, the peripheral speed of the collars is high, and this makes lubrication difficult, and increases the resistance due to friction. The shaft is usually of mild steel, and should be carefully forged in one direction, and not half in one direction and half in the other, as this introduces a weakness in the shaft. In some cases 3 per cent. to 4 per cent. of nickel is added, and this gives a stronger shaft.

Detail Calculations

All the advantages lie with a shaft having a large number of small collars, except the fact that it is very complicated. In calculating the dimensions of the various parts of the shaft and the block, the formulæ used are largely empirical, although theoretical formulæ can be used to a certain extent. From elementary mechanics we have:—

Work done = force × distance, thus we get effective horse-power =

$$\frac{\text{Thrust (in lbs.)} \times \text{Speed (feet/min.)}}{33{,}000}$$

From this we have, Thrust $= \dfrac{\text{E.H.P.}}{\text{Speed.}} \times 33{,}000$.

The effective H.P. bears some definite ratio to the I.H.P., depending on the mechanical efficiency of the engine and bearings.

The usual ratio may be taken as

$$\frac{\text{E.H.P.}}{\text{I.H.P.}} = .77 \text{ for best high-speed engines.}$$
$$= .68 \text{ for merchant boats.}$$
$$= .80 \text{ for turbines.}$$

Thus we get, Thrust $= \dfrac{\text{I.H.P.}}{\text{S.}} \times y \times 33{,}000$, where y = mech. effy.

Hence we see that, Thrust varies as $\dfrac{\text{I.H.P.}}{\text{S.}}$

This thrust is usually called the mean normal thrust. It is clear that the thrust is excessive when the speed is slow, i.e., when the ship is starting, or towing, or going against a strong head wind. Thus, although we have the mean normal thrust to base our calculaltions on, the shaft must be designed to take up the maximum stress, which occurs when starting or towing. There are various formulæ available. One which gives the area directly, and with a fair degree of accuracy is

Bearing surface of collars in sq. ins. = .6/I.H.P., i.e., 0.6 sq. ins. for each I.H.P. developed

A better way is to take a certain allowable pressure on the working bearings. Good values for these pressures are:

50 to 80 lbs. per sq. in. for mercantile marine.

80 to 100 lbs. per sq. in. for naval.

A rough rule for finding the number of collars to be used is given by

1 collar up to 5 in. dia. of shaft, and an extra collar for every 1.8 in. dia.

or, $N = 1 + \dfrac{d-5}{1.8}$ for mercantile marine,

and $N = 1 + \dfrac{d-5}{1.25}$ for naval and express.

The diameter of the shaft, as stated before is found from Lloyd's rules, hence we have to find the diameter of the collar.

Total bearing area

$$A = \frac{pi}{4}(D^2 - d^2)\ N = \text{sq. ins.}$$

where D = dia. of collar.
d = dia. of shaft.
N = No. of collars.

Total thrust = total area × allowable pressure.

$$T = A \times P.$$
$$= P \times \frac{pi}{4} \times N\ (D^2 - d^2)$$

From which D can be found.

In practice the rule for the thickness of the collars is given by

$$T = 0.4\ (D-d).$$

The space between the collars is found by:

(i.)—Rings of solid brass T=0.4 (D—d)

(ii.)—Rings of cast iron lined with brass or white metal } T = 0.75 (D—d)

(iii.)—Rings of C.I. hollow to allow for water circulation } T = (D—d).

Another rule for giving the pressure on a thrust bearing is

$$\text{Pressure in lbs. sq. ins.} = \frac{800}{\sqrt{R\,d} + 100}$$

where R = revs. per min.
d = dia. of shaft in ft.

The thrust shaft and block are usually placed next to the crank shaft inside the engine room if possible, so as to permit inspection of the block by the engineer in charge. The shaft is supported at each end by a pillow block so as to prevent any vibration which would cause an inequality of pressure on the thrust bearings.

Solid Type Thrust Block

There are three types of thrust blocks in use. Fig. 1 consists of a cast iron base block and cover, the division being horizontal. Rectangular grooves are

turned in these, in which brass thrust rings are fitted. The rings are scraped to make a good fit with the collars on the shaft, and small radial oil grooves are cut in the former. When this block gets hot it usually necessitates the stopping of the engine, and the removal of the thrust shaft or the block, in the event of a serious heating and damage to one or more of the collars. The block is not generally constructed to admit of slipping it out by dropping sufficiently to clear the shaft, so that the disconnecting of the shaft is necessary as a rule before the block can be got out. Both the cover and base of the block are water cooled, but even with this the block is unsatisfactory, and is rarely used now.

Horse Shoe Type Thrust Block

For large engines, Fig. 2, the horse-shoe type is almost universally installed. It consists of a cast iron bed cast so as to provide a bath for lubricant, in which the shaft runs partially immersed. Cast iron shoes, hollow to permit of water circulation, and lined on each face with white metal, rest in position between the collars as shown. A fine threaded screw goes on each side of the shaft down the whole length of the block, and gun-metal nuts on these hold the shoes in position. The water service, not shown in the drawing, is arranged so that each shoe has a separately controlled supply of water. Hence the temperature of the whole block can be equalized, and this is conducive to smooth running.

The bearings at each end have stuffing boxes, so that the oil can rise above the bottom of the shaft, and usually immerses half the shaft. This oil, in many cases, is cooled by small water tubes passing starboard to port, through the oil bath. The cooling surface need not be large if the shoes are water cooled, as most of the heat generated by the friction is carried away by the water service through the shoes. Since the shoes are of the horse-shoe type, the centre of pressure of the bearing area is above the centre of the shaft. The thrust screws are, however, arranged so that they are on the same level as the centre of pressure, and thus the shoes bear evenly against the collar. The chief advantage of this type is the fact that each shoe can be adjusted independently of the rest. Also if one shoe "fires up," it can be removed and replaced without stopping the engine. It also entails less spare gear. Lubrication is greatly assisted by the oil bath, and the oil grooves are cut in a special manner as shown. The chief difficulty in lubrication is due to the fact that the centrifugal action of the collars tends to throw the oil out immediately. Also, there is no real point of "no pressure" at which to introduce the lubricant, as in ordinary journal bearing.

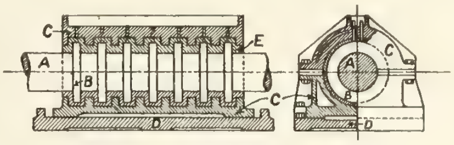


FIG. 1. SOLID THRUST BLOCK.

Vertically Divided Type

A third type, Seaton's "Marine Engineering Rules and Tables," is similar in general construction to Fig. 1, but the division of the two halves is vertical and not horizontal. This enables the block to be examined without removal of the shaft, as the two halves are made so as to slide out horizontally. Another improvement in the construction enables the whole of the bearing surfaces to run in a bath of lubricant. This type, however, is only used for small engines. In every type there is a small clearance between the shaft and the inside of the shoe or brass ring, since the block is designed solely to take the thrust of the propeller, and not the weight of the shaft. The block is bolted to the frames of the ship by means of a seating plate on which it rests. This plate is secured by tie beams and girders longitudinally to several frames, so that no excessive strain is exerted on any part of the ship. With modern thrust blocks the loss due to friction is now comparatively small, although authorities differ on this subject. Good values for the loss expressed as a percentage of the total power are as follows:—

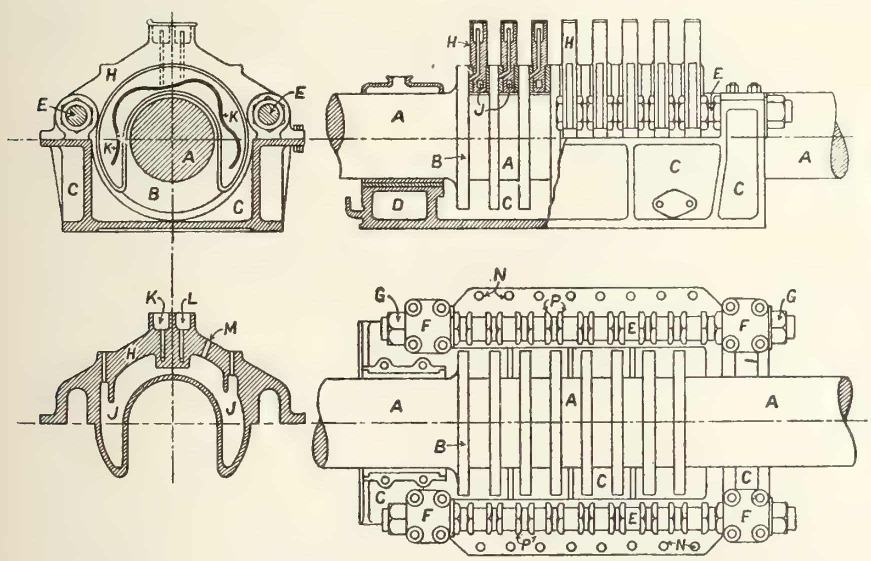


FIG. 2—HORSE-SHOE THRUST BLOCK WITH INTERNAL WATER SERVICE

Mercantile marine	0.4%
Express steamers and large naval boats	0.5%
High revolution and small naval boats	0.65%
High revolution turbines ..	1.0 to 1.3%

A general rule for all is

$$\text{Loss}\ \% = 0.5\sqrt{\text{R.P.M.}}$$

When Parsons turbines first came into prominence, the thrust block was not so important, as the steam pressure was arranged to balance the thrust, but now that helical gearing has been introduced the thrust must be taken up as before. Experiments have been carried out with roller and ball bearings, but these have had, so far, little success. Perhaps now that greater accuracy in making the balls has been obtained, this may be more successful.

The foregoing is from the pen of the late Eng. Sub-Lieut. Chas. P. Tanner, R.N., under the nom-de-plume "Helix," and secured the first award in the Graduate Section, Institute of Marine Engineers. He lost his life aboard the Indefatigable on May 31, 1916.

STEAM TURBINE PROGRESS

THE employment of the steam turbine in electric generating stations has made rapid progress during the past ten years, and for this reason much interest attaches to the facts set out in a paper read by H. L. Guy before the Manchester Association of Engineers recently. Reference was made to changes in the types of machines employed. It has now been established that a pure high pressure turbine is more efficient than a combination of a reciprocating engine exhausting into a low-pressure, or mixed pressure turbine, with the result that high-pressure turbines are being installed where the former types were adopted a few years ago. This represents a distinct advance in the art of turbine construction.

Another change which has taken place is the tendency towards increased outputs at high speed, and figures were quoted to show that at 3,000 k.w. the steam consumption with a 3,000 r.p.m. set is 6.15 per cent. better than at 1,500 r.p.m, while the cost per kilowatt is 27.8 per cent. lower. For a 5,000 k.w. set, the steam consumption at 3,000 r.p.m. is 2.67 per cent. better, and the cost per kilowatt 26.2 per cent. lower. It was pointed out that the success of impulse turbines has been in a large measure due to the fact that the pressure and temperature inside the turbine casing are kept low by allowing a much larger expansion in the first than in succeeding stages, with the result that the full boiler steam pressure and temperature are small chambers, and can when necessary be made of cast steel at a reasonable cost.

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Vol. VII APRIL, 1917 No. 4

PRINCIPAL CONTENTS

THE SHIPBUILDING SITUATION

A GOOD deal of enthusiasm has been aroused not only among interests closely related to the twin crafts of shipbuilding and marine engineering, but among those more or less indirectly concerned, because of the fact that in both these spheres of industrial endeavor, our plant capacities are more or less taxed with orders—in a word, there is quite a little boom on. The foregoing is true of both wood and steel construction, although the latter easily predominates. Some misconception is, however, abroad as to the direction of effort and scope of the meantime activity. Aside from a little vessel construction to the order of private individuals or shipping corporations, both the British and Canadian Governments through their accredited representatives—the Imperial Munitions Board on the one hand and J. W. Norcross, vice-president and managing director of the Canada Steamship Lines, on the other—have placed various contracts, the former for ocean-going freighters and the latter for a type of craft whose service will be more or less confined to ocean coastal waters.

As regards the coasting vessels, quite a fleet has been ordered, and in view of the circumstance that completion and delivery of all are required within some six months' time, it may perhaps be unnecessary to state that hulls and machinery are well advanced in construction in not a few instances. Delivery on the ocean-going freighters, orders for which have for the most part already been placed, is called for by mid-Autumn, 1918.

We had hoped that some definite action towards the production of ship and boiler plate would have been taken by one or other of our large steel interests ere this, but notwithstanding rumors to that effect, no move has been made in the direction indicated; as a matter of fact we are apparently further away than ever from being in a position to meet, at least, our own needs in ship and boiler plate, and that in normal circumstances. Shipbuilding within our borders to be robust must, of course, be subsidized in some form or other, and until some steps are taken to so encourage it, the plate mill essential is likely to remain a dream for future realization.

CAPTAIN FRYATT MEMORIAL FUND

WE HAVE pleasure in bringing to the attention of our readers the matter of the Captain Charles Fryatt Memorial Fund which the Imperial Merchant Service Guild have undertaken to raise. A two-fold object is in view, that of the erection of a public memorial to the late Captain Fryatt, and the creation of a fund for the benefit of distressed merchant ship officers or their dependents—caused primarily, of course by the war. We as Canadians can now clearly discern how much we owe to the men and ships of His Majesty's Merchant Service. It is desired to perpetuate Captain Fryatt's name, and its historical setting, and as becomes his confreres, action is being taken so that the ghoulish piracy and murder lust of the Hun as practised on the high seas may not readily be forgotten or overlooked, even although surpassed they may be by other horrors and tragedies in related spheres of our Empire effort. From our interned navigators, from the bridge, poop, or quarter deck of the coast patrol fleet, the mine vessels, the hospital ships, the tow boats and trawlers, all lake, river, coastwise and ocean traders, the foghorn calls out in the thick of the fight—stimulate our profession that we may hold intact the Empire's commercial status on the waters of the Globe

Captain Geo. S. Laing, 20 Gibson Avenue, Toronto, will be glad to furnish further information concerning the movement and its progress to all interested.

In our May issue, a list, complete as far as then available, will be given of Canadian lake, river and ocean-coasting vessels, together with the names of their captains and chief engineers. The navigation season of 1917, now just opening, will by that time be in full swing, and that it may be alike successful and free from untoward disaster and tragedy is our wish for all concerned in its variety pursuit and experience possibilities.

MARINE NEWS FROM EVERY SOURCE

Goderich, Ont.—The Goderich Dry Dock & Shipbuilding Co. propose building a ship-repairing plant here.

Shipwrights' Wages Raised.—A ten per cent. increase in the wages of all its workmen has been given by the Port Arthur Shipbuilding Co., Port Arthur, Ont.

The Hall Engineering Works, with which is associated the Montreal Dry Dock Co., have started work on a new 50 by 150 feet plate and boiler shop at the plant of the latter. In addition to equipment already on hand, more new machinery will be required.

Big Demand for Ore Tonnage.—John Bell, general superintendent of the Playfair steamship interests at Fort William, Ont., after an extended trip to Buffalo, Cleveland and Chicago, reports there is a very heavy demand for tonnage for ore.

Montreal, Que. — Extensive improvements at the Canadian Vickers shipyard are now approaching completion. New berths and other extensions which have been undertaken at an estimated cost of $1,000,000, are expected to be entirely completed by May 15.

Pictou, N.S.—At a well attended ratepayers meeting held on March 22, a resolution was unanimously passed authorizing the Town Council to ask for legislation to bonus a proposed steel shipbuilding plant to the amount of $50,000.

Victoria, B.C.—The auxiliary schooner Laurel Whalen was launched at the Cameron Genoa Mills shipyard on March 24. The christening ceremony was performed by Miss Marjorie L. Brewster, daughter of Hon. H. C. Brewster, Premier of British Columbia.

Halifax, N.S.—An Act for the encouragement of shipbuilding in Nova Scotia has been introduced in the Legislature. The bill authorizes the appointment of a commission to investigate the existing facilities for building ships and manufacturing industries incidental thereto.

Coal Carriers Purchased.—For the purpose of being used in the coal carrying trade between Sydney and Montreal, the Government, through the Department of Railways and Canals, has concluded the purchase of two steamers, the Drummond and the McKee. The ships which are of substantial carrying capacity, were secured from the Algoma Companies. Particular efforts are being put forth both to increase the coal production in Nova Scotia and to better the carrying facilities.

Russians Buy Freighter on Great Lakes.—The steamer Nevada of the Goodrich Line, built at a cost of $275,000 in 1916 to carry passengers between Milwaukee and Chicago and equipped for winter traffic with ice-breaking bows, was recently sold to representatives of the Russian Government for $750,000. It will be used in the freight trade to Russian ports. The steamer will go to the Atlantic by the Welland Canal this spring and probably will be used to carry munitions to Russia.

Welland Canal Work Suspended.—Blasting on section 3 of the Welland Ship Canal to prevent the accumulation of water which has continued during the winter has been completed, and the Rock taken to Port Weller to hold the earthen breakwater embankment in place. Work on the big undertaking is now at a standstill, and will remain so until the end of the war. Thirteen locomotives owned by Baldry, Yerburgh & Hutchinson, contractors for section No. 2, have been secured by the Government, and are to be sent to France for military construction work.

Wood Shipbuilding Development.—A loan of ten million dollars offered by the Government to the Imperial Munitions Board to aid in the development of wooden shipbuilding in Canada has been accepted. Specifications and designs of the type of wooden vessels required have been under discussion between the Board, the representatives of the British Minister of Shipping, and various shipbuilding firms. It is hoped to begin work very shortly, and the building of a considerable number will be arranged for in Canada, probably for the most part on the Pacific Coast, where suitable lumber is available in abundance.

Must Install Water Purifiers on Lake Boats.—Before the opening of navigation vessel owners of the Great Lakes must spend approximately $300,000 for the installation of new culinary and drinking water purifiers on all boats engaged in interstate traffic. The order applies to all vessels belonging to Canadian steamship companies plying on the Great Lakes. The order requiring installation of pure water systems was issued some time ago by Dr. J. O. Cobb, Chicago, surgeon of the sanitary district comprising the Great Lakes. The water must be treated by an approved method, and the piping system on all vessels must be so arranged that no connection can be made between the drinking water system and any other water system.

Toronto Harbor Contracts.—Six hundred thousand dollars' worth of pierhead construction work was contracted for on April 12 by the Harbor Commission. The work is split among three concerns—R. Weddell & Sons, Trenton and Toronto; Port Arthur Construction Co., and J. O. Roddick, Toronto. The three contracts will constitute the summer work on the harbor improvement, and call for the construction of crib substructures and concrete wall from Bathurst street east to York street. The total distance is 6,000 feet, so each concern contracts to construct 2,000 feet of wall. Section No. 3 immediately East from Bathurst street, will be built by the Weddell concern; J. O. Roddick will construct centre section No. 4, and the last stretch of pierhead to York street will be put in by the Port Arthur Construction Co.

Conference of Shipbuilders. — Sir George Foster, acting Prime Minister, held a conference at Ottawa on March 28, with the representatives of a number of Canadian shipbuilders, who are building ships in Canada for the British and Canadian Governments. The object of the conference was to discuss plans to systematize and speed up construction. The programme as already announced includes ships to the value of $25,000,000 being built for the British Government under the authority of the Imperial Munitions Board, as well as a number of vessels being built for a Canadian Branch of the Government Service. The contractors were able to report to the Acting Prime Minister that good progress is being made although some difficulty has been encountered in procuring steel. It is understood, however, that this is being overcome. It is stated in this connection that another big British shipbuilding company is likely to establish a branch shipyard in Canada.

Wrecking Interest Sold.—The Reid Wrecking Co., of Sarnia, has sold its Canadian interests to the Canada Steamship Lines. It is understood that the deal includes the tugs James Reid, Sarnia City, and Smith, all powerful towing boats, besides the Sarnia docks and machine shops of the Reid Co. The Reids used these tugs for towing log rafts and on wrecking jobs, but

they still have the Fischer, and Manistique, and the dry-dock at Port Huron. The company has also sold the steamer Kongo to Muskegon parties, and her name will be changed to the Overland. The Reids purchased her last Fall at Buffalo.

Rebuilding Ferry Boat.—The Canadian steamer Hiawatha, of Sarnia, is being rebuilt at the Wolverine Dock, Port Huron. This boat runs on the local ferry line.

AUXILIARY POWERED SCHOONER "LAUREL WHALEN" LAUNCHED

GAILY bedecked, and in the presence of several thousand spectators, the auxiliary powered schooner Laurel Whalen was launched from the Cameron Genoa Mills Shipbuilders' yard on afternoon of March 24. Miss Marjorie L. Brewster, the young daughter of Hon. H. C. Brewster, Premier of British Columbia, although only eleven years of age, carried out her role as sponsor with charming grace, and as the vessel started, almost imperceptibly at first, on the downward course the little lady sent the beribboned bottle of champagne crashing against the bow and the Laurel Whalen officially received the name by which she will soon be known in distant ports of the world. In her arms Miss Brewster caried an immense bouquet of American Beauty roses and after the ceremony she was the recipient of a handsome present.

With the launching of the Laurel Whalen there are now four of the fleet of ten vessels ordered by the Canada West Coast Navigation Company afloat, their names being as follows in the order of their launching: Mabel Brown, Margaret Haney, Geraldine Wolvin and Laurel Whalen. The next boat to be launched will be the Jessie Norcross, named after the wife of J. W. Norcross, vice-president and general manager, Canada Steamship Lines. The vessel is building at the Wallace Shipyards, North Vancouver. There remain now on the ways of the local shipyard two more vessels, of the same class as the Margaret Haney and the Laurel Whalen, and work on these two ships will be carried on with all dispatch. The next boat to be launched will be the Esquimalt. The fourth schooner has not yet been named.

Prominent People Present

On the launching stage Premier Brewster was accompanied by other members of the Executive Council, while representatives of every public department and of the business community were present, including civic officers, railway representatives, naval officers, municipal officers, shipping and insurance representatives, the clergy, boards of trade, clubs, legal firms and others.

All four of the schooners now afloat have been chartered to the Canadian Trading Co. The Mabel Brown will load for Sydney, the Margaret Haney for Calcutta, the Geraldine Wolvin for Melbourne and the Laurel Whalen for South Africa.

UPPER LAKES S.S. "WESTMOUNT" LAUNCHED

THE bulk freighter Westmount, which has been built to the order of the Montreal Transportation Co., by the Collingwood Shipbuilding Co., Collingwood, Ont., was successfully launched on April 5, Mrs. L. L. Henderson, wife of the president of the owners company, christening the vessel. The "Westmount" is one of the largest vessels yet constructed in Canada, and is of the single-deck type which has been evolved to meet the conditions prevailing on the Great Lakes of North America in regard to the transportation of bulk cargoes of coal, ore and grain. Her leading particulars are: Length over all, 550 feet 8 in.; length B. P. 537 ft.; breadth moulded, 58 ft.; depth moulded, 31 ft.; load deadweight, 11,000 tons; load draught to suit canals, 19 ft. 6 in.

Loading and Unloading Provision

The vessel, in common with the other ships of her class, embodies a number of features introduced to facilitate loading and unloading operations, the short season for navigation on the lakes making quick despatch in port a matter of the utmost importance. No loading or discharging appliances are provided on board, these operations being accomplished by the shore plant. There are 16 cargo hatchways, each having a width of 38 ft. and a length of 9 ft. The hatchways are spaced 24 ft. apart centre to centre to suit the standard spacing of the loading and unloading devices on shore. Between the hatchways, strong arch girders or web frames, extend right round the sections. By the adoption of these girders stanchions are dispensed with and the holds left unobstructed, a necessary feature where coal and ore cargoes are unloaded by clam-shell buckets, as is the case on the Great Lakes. For the same reason there are no deckhouses, spars or other obstructions for the length of the cargo holds.

The ordinary transverse bottom and side frames are of channel sections and are spaced 3 ft. apart. The double bottom, which is 5 ft. deep, extends for the full length betwen the peak bulkheads. Side tanks of the same width extend on each side up to the level of the main deck stringer, and thus form a double skin to a height well above the deep load line. The side tanks provide large additional capacity for water ballast, while their inner plating transforms the hold into a compartment of hopper form section, eminently suitable for mechanical unloading operations.

The tank top plating, which carries the weight of the cargo, is supported by the centre girder and by four continuous longitudinal girders on each of the centre line. Intercostal deep floor plates are fitted in the transverse direction at every second frame, i.e., 6 ft. apart, there being a deep floor at each arch girder and one between. There are two collision bulkheads forward, the space between forming a deep tank.

The cargo hold is divided by screen bulkheads into six compartments and the double bottom by four watertight divisions into five compartments for water ballast. The remaining bulkheads are a cross bunker screen bulkhead, a screen bulkhead between the engines and boilers, and a watertight after peak bulkhead. The upper deck stringer and plating between the hatch and ship's sides are supported by longitudinal channel girders instead of transverse beams. This arrangement is a new feature in a vessel framed on the transverse system, and has the advantage of introducing additional longitudinal strength at a very desirable part.

A short forecastle is fitted above the upper deck right forward. On the port side under the forecastle deck are arranged cabins for the first and second officers, the quartermasters, and watchmen. In a corresponding position on the starboard side are the owner's staterooms. On the forecastle deck above is situated a large steel deck-house containing an observation room and the captain's quarters. The top of this house forms the navigating bridge, upon which stands the wheelhouse.

The accommodation provided at the after end of the ship is arranged in a large steel house surrounding the engine and boiler casing. Here are placed the engineers' quarters, galley, dining-rooms for the owner, officers, and crew, respectively, and berths for various members of the crew. The firemen's accommodation is situated on the main deck at the starboard side just abaft the engine-room casing.

Ship Deck Machinery

A powerful steam windlass, of the Emerson-Walker quick-warping direct grip type, is located on the upper deck forward under the forecastle. The cables are 2¼ in. in diameter, each being attached to a "Britannic" stockless anchor of 8,000-lb. weight. The anchors are stowed in suitably shaped pockets, so that they may not foul lock gates or other obstacles when the vessel is navigating narrow waterways.

The main and emergency steam steering engines are situated right aft on the main deck. Both gears consist of a 9 in. by 9 in. steam engine supplied by the American Engineering Co., of Philadelphia, which actuates the rudder directly through a toothed quadrant connected to the rudder stock. This gear is controlled by wires led from the steering wheel in the pilot-house or that on top of same, The emergency gear is always under steam, and can be put into operation in a few seconds by means of a crank on the bridge steering standard, which at the same time throws out of action the main gear.

The deck winches, which number six in all, have been supplied by the Chase Machine Co., of Cleveland. Four of these are 8 in. by 10 in. single-drum mooring units, and are placed two at each end of the row of hatchways. The drums of the mooring winches are arranged in an athwartship direction, fairleads of special design being provided at the ship's side to lead the mooring ropes.

Another 8 in. by 10 in. single-drum winch is located in the windlass room forward, while an 8 in. by 10 in. winch, having two drums, is situated on the upper deck aft. One drum of the after winch is intended to take the 3½ in. mooring hawsers, while the other takes the 4½ in. wire hawser which is attached to the stern anchor of 4,000 lbs. weight. The latter, which is also of the "Britannic" stockless type, is stowed on an inclined platform, so that it can be instantly lowered in case of emergency.

General Equipment

The boat outfit consists of two 22-ft. metallic lifeboats and one 18-ft. gasoline launch, for use in harbor, capable of attaining a speed of 8 miles an hour. All the boats are placed aft at the level of the deckhouse top, and are attached to davits and equipped with Huff's releasing hooks.

The vessel has two steel pole masts, one forward and one aft, for signalling purposes and to carry the running lights. Awnings are fitted over the forecastle deck and the pilot-house and at the sides of the after deck-house. Draught gauges are provided at each end of the ship, so that the draught forward and aft may be read in disturbed water or at night.

The ship is lighted throughout by electricity, the total number of lights being about 200. For providing the necessary current there are two electric generators, each having a capacity of about 10 kilowatts. The generators are situated on a flat at the after end of the main engine room. An electric indicator is placed in the pilot-house to show whether all the running lights are in order.

Propelling Machinery

The propelling machinery, which has also been constructed by the Collingwood Shipbuilding Co., is located at the after end of the vessel. Steam is generated by three single-ended cylindrical boilers of the Scotch marine type, each having a diameter of 13 ft. and a length of 11 ft. The boilers are designed for a working pressure of 185 lbs. per sq. in. and are provided with Howden's system of forced draught. From the boilers the steam passes to a single set of triple expansion reciprocating engines having cylinders 24, 40 and 66 in. diameter respectively, by 42 in. stroke. The engines are capable of developing about 2,400 I.H.P. which will drive the ship at a speed of about 13 miles per hour when loaded, and 15 miles per hour when light.

The auxiliary machinery includes one centrifugal and two duplex ballast pumps, one sanitary pump and one deck pump, one duplex main feed pump and one duplex auxiliary feed and fire pump. The air, circulating, and bilge pumps are direct driven from the main engines. In addition to the steam pumps, hand bilge and fire pumps are provided both forward and aft.

The steamer will be sailed by Capt. S. Hill with J. Norris as chief engineer .

TRIAL TRIP OF AUXILIARY POWERED SCHOONER "MARGARET HANEY"

WITH a number of invited guests aboard, the auxiliary schooner Margaret Haney spent the greater part of the day of April 5 in a cruise which extended from Victoria harbor out to the eastward as far as Trial Island, and following a semi-circular route, returning by way of Port Angeles, the vessel behaving splendidly throughout the entire trip. A few days later she left for Vancouver to take on a full cargo of lumber from the Rat Portage Lumber Co. mill for delivery at Bombay, India.

Capt. Whitely piloted the Haney on her trial, Capt. G. S. Lapraik representing the owners, while included in the passenger list were H. W. Brown, manager of the Canada West Coast Navigation Co., the owners; J. O. Cameron and D. O. Cameron, of the Cameron Lumber Co., who were the first to undertake the building of ships in Victoria; Harry McDevitt of the Empire Lumber Co.; W. H. Bullock-Webster of the legal firm of Bullock-Webster & Bass; S. Baxter, Provincial Boiler Inspector; Geo. Kirkendale, shipping master of Victoria; T. G. Mitchell, Lloyd's surveyor for British Columbia; D. Stevens; Clarence Carter, of the Carter Electric Co.; R. Dowswell, R. C. Ross, W. Cairnes Harper, E. Rochon, E. W. Hume and others.

Makes Good Speed

During the trials, the Margaret Haney made, with sail and power combined, and a breeze of about 3, Beaufort Scale, an average of ten knots per hour. Unfortunately, however, the wind was not of sufficient duration and force to warrant a satisfactory trial with sail power alone, but the management and the experts on board expressed themselves as more than satisfied with the results attained. Weather conditions were ideal for holding the trial, except for the lack of wind, and upon their return to port everybody declared that a most enjoyable and profitable day had been spent, having learnt something about the construction and the working of the locally-built ship.

The auxiliary powered vessels being built on the Pacific Coast are all of the Margaret Haney type, and are capable of being handled by eighteen men, including captain, two mates, three engineers, one donkeyman, two apprentices, seven seamen, cabin boy and cook. The officers' quarters are located under the poop deck and are very conveniently laid out, while the quarters for the crew are situated forward.

Oil Fuel Provision

G. Kingsland, superintending engineer for the company, laid out the engine room, tank, fuel and water arrangements and the engines were installed in the Margaret Haney under his instructions by A. T. Blythe. The fuel used is crude oil. The main fuel pumps draw fuel from any one of the six main fuel tanks and discharge into the service tanks; they can also be used for trimming purposes by discharging back into any one of the six tanks. The fuel pumps are in duplicate so that in case of any accident where one goes wrong the other can be used. The system of filters on the main fuel line is so arranged that either of the filters may be taken out and cleaned without in any way hindering the flow of fuel to the main engines.

Propelling and Auxiliary Machinery

All the auxiliary engines on the boat, which include windlass, four winches, one fire pump, bilge pump and two fuel pumps, can be run on either steam or compressed air. The steam is furnished by a donkey boiler located under the fo'castle head, and the air by two compressors on the main engines and one auxiliary compressor driven from the electric light plant. The main engines consist of two 160 horse power Bolinder engines, from Stockholm, Sweden. The horse power is developed at 225 revolutions per minute, giving the ship a speed of approximately 8 knots under power alone.

The engines are of the two-cycle type, as is most common among semi-Deisel engines. A direct reversible mechanism consisting of a one-way clutch allows the propeller to turn free when the vessel is under sail. This means that practically all drag from the propellers will be eliminated as when the ship attains a speed of over 2 knots, the propellers will turn of their own accord. This clutch is manipulated by compressed air, and the rams used for the purpose were built in Vancouver.

Reversing Gear

The reversing gear is very simple, being controlled by one lever which automatically stops the injection of fuel from the fuel pumps and, as the engine comes to rest, injects a single jet of fuel into the cylinder as the piston is on the up-stroke. The pressure caused by this explosion brings the piston to rest and starts it on the down stroke before it reaches top centre.

The fuel consumption of the engines when developing their rated horse power of 160, is a little over eleven gallons per hour, and as the fuel tanks have a capacity of 30,000 gallons, it will be seen that the vessels have a large cruising area.

Electric light is furnished throughout the ship by a four kilowatt Canadian Westinghouse generator which is driven by an eight horse power Bolinder engine of a similar type to the main engines. This engine also drives an auxiliary air compressor which may be used when the main engines are at rest to furnish compressed air for operating either the bilge or the main fuel pumps.

Ventilation in the engine room is furnished by two skylights, located at the after end, and two ventilators, one on each side. The circulation of air from these keeps the engine room at a moderate temperature, and it is not expected that it will become excessively hot even when the ship is in a tropical climate.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

W. G. Ross, chairman of the Harbor Commissioners of Montreal, went to New York recently to attend an executive meeting of the American Association of Port Authorities. Mr. Ross is president of the Association.

Capt. Alfred Potter of Canning, N.S., died at the Victoria General Hospital, Halifax, on April 6. Capt. Potter was about the last of the old time master mariners who navigated the ships of Nova Scotia Province over the seven seas. The last of the square riggers sailed by Capt. Potter were the Cornwallis and the King's County, engaged largely in cross Pacific trade. Three times since the war broke out he had successfully delivered lumber cargoes to Great Britain in the three-masted schooner Kenneth C. Two years ago he made a record trip from Halifax to Preston, England—sixteen days.

Captain C. O. Allen, of Halifax, N.S., has been taken prisoner aboard a German submarine. The Stadacona belonging to the Canada Steamship Lines, on which he was master, has been torpedoed and sunk. The other members of the crew have landed in England. Captain Allen, who was one of the noted master mariners of the sailing ship days in Nova Scotia, retired from seafaring over fifteen years ago and settled down on a large orchard property in the Annapolis Valley. When the war broke out, he felt that at sea he could be of service to his country, and he accepted command of the steamer Wanota. Later he was transferred to the Rosedale, and, after coming home last November and disposing of his orchards, he was sent to England to take command of the Stadacona. Since the outbreak of the war, he has been constantly sailing to ports in the war zone and on two occasions had narrow escapes during German air raids on an English port. At Havre, on one occasion, through a misunderstanding and his inability to speak French, he was held for a number of hours on suspicion of being a German spy. The Stadacona was on a voyage from Dunkirk to Marseilles.

SEA SCOUTS ON STEAMERS

WHEN the hospital ship Britannic was commissioned, the White Star Line shipped some Boy Scouts as an experiment and this proved so successful that the number was extended later. That the new departure was fully justified is shown by the bravery of the boys when the vessel was sunk by enemy attack, and one of them, Patrol-Leader Ireland, has been awarded the coveted Cornwell Badge for Bravery by the Chief Scout, Sir Robert Baden-Powell.

Both the authorities and shipowners have watched with interest the experiment of carrying these lads, and tho American Lines have now decided to start a scheme in their larger passenger vessels by which the supply of boys from training ships and training homes will be supplemented by members of the Scouts Associations in Liverpool, London, and Southampton enrolled as Sea Scouts. These associations will be invited to recommend boys from 13 to 15 years of age, of certified fitness, good character, and smart appearance, who are desirous of going to sea, and, from these, the marine superintendent will select two "bridge boys" per steamer whose duties will consist of assistance in signalling, attending telephones, running messages, and generally helping the qaurter-masters.

The youngsters will be rated as deck boys at first, and later as ordinary seamen (with pay accordingly), with the idea that they will afterwards qualify as able seamen, pass a special examination by the marine superintendent's staff and be subsequently given an opportunity to rise to the rank of petty officers. If the mettle already shown by the scouts is any criterion, the new field of activity thrown open to them by the continual interest in this national movement on the part of Liverpool shipowners should prove of lasting value alike to the boys and the personnel of the British Mercantile Marine.

Shipowners will, we make no doubt, watch with considerable interest the working of the above scheme as promising a new source of supply of seamen for our mercantile marine, but we should like to ask if equal thought is given to meeting the possibility of a famine in marine engineers, says the Liverpool Journal of Commerce. The subject is well worth attention and consideration—even in war time.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

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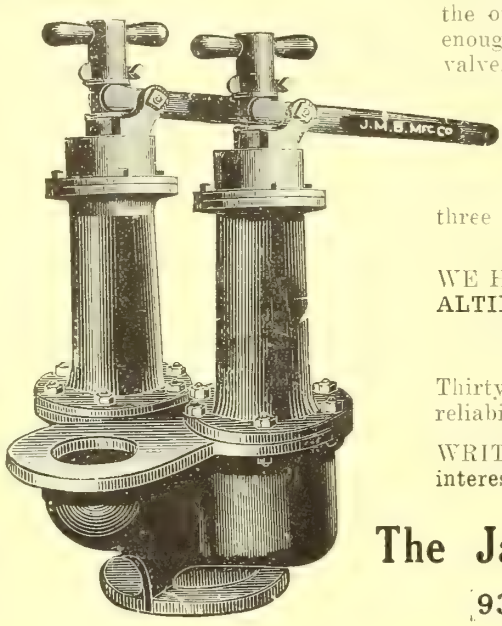

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Standardization Applied to Cargo Boat Machinery*

By D. B. Morison

The industrial problems of the future must be faced, and faced quickly — moreover, they must be solved, and solved quickly. The onus of responsibility falls primarily on capital, in the provision of standardized organization, direction ,and equipment, whereby the best is accurately determined and the best is progressively maintained; thereafter capital and labor must co-operate in standardizing rapid production, so that good general trade may be promoted by steady employment at high wages to the lasting benefit of the industries concerned and the general welfare of each individual community, and the nation as a whole.

ALTHOUGH it is imperative that maximum effort, individual and collective, should be concentrated on winning the war, it will be well if our energies can be so directed that, without in any way prejudicing the main issue, they may be helpful towards a solution of the stupendous industrial problems ahead of us, and in avoiding the dangers of "too late." In engineering and shipbuilding the period of grace will be extended by reason of the general shortage of tonnage, but the deluge of world competition will be with us ultimately as sure as night follows day, and our success or failure will depend entirely on the use we make of the time and opportunity between now and then.

Capital and Labor

It is futile for capital to expect that labor will consent to any great reduction in wages. It will be equally hopeless for labor to expect the maintenance of the present high rate of wages without concessions on its part. Therefore, let both capital and labor seek whether by joint endeavor it will be possible to pay high wages in the future and yet maintain our trade. The requisites are, first, a candid acknowledgment by labor of the economic law that good general trade is dependent on maximum production, and, secondly, capital must recognize that maximum production entails correspondingly high pay. Capital and labor must realize that their interests are parallel, not divergent. Assuming that this fundamental principle is accepted, then the onus of organized preparation falls on the employer, as, unless unrestricted effort is well directed, its standard of useful efficiency will be so low that ultimate failure is inevitable. There can be no industrial success in this country of the degree demanded by the obligations of our national indebtedness without the full employment of labor at the highest standard of useful efficiency. Such a standard is only possible with the most perfect mechanical equipment and the most efficient general organization and management on the part of the employer, and with unrestricted effort and correspondingly high wages on the part of the employed. The manufacture in multiple of an arbitrary design is not standardization; it is merely repetition with the object of obtaining greater output. To standardize is:—

"Accurately to determine the best—progressively to maintain the best—and to produce of that best the greatest quantity by means of organized specialization in labor, in methods, and in machinery."

Progressiveness in Standardization

Progressiveness in standardization with regard to designs depends on how nearly reasonable finality has been reached. In the case of a pin or a pen, for example, improvement in design is barely possible. In a machine comprising an aggregation of parts, such as a self-binding reaper, the desired effect having been obtained, progress can only be associated with means for reducing the cost of manufacture or increasing the rate of work. The economic effect of obtaining the greatest possible power from steam by means of an engine is of such vast importance that the determining of the best, and the progressive maintenance of the best, are factors which also determine whether any given type shall continue to exist. Consequently the initiation of a standardized marine engine requires extraordinary care and ability in order that the standard shall be unsurpassable in efficiency both thermally and mechanically.

AUXILIARY POWERED SCHOONER "MABEL BROWN," FIRST OF ITS TYPE BUILT IN CANADA

Propelling Machinery Standardization

A single mistake in determining the best in a standard engine prejudices for its entire life the commercial value of the ship that it drives, whether the mistake be reflected in steam inefficiency or mechanical inefficiency. It would seem, therefore, to be of paramount importance that the initial decisions should be vested in a body of marine engineers who are life specialists in the design, the manufacture, and the running of cargo boat machinery. In other words, the engine must start off as the leader of its type, it must maintain this lead, and the leadership must be generally acknowledged by cargo boat machinery experts. The incorporation in one design of the latest and best practice as affecting steam efficiency and running costs would provide a measure, but the measure itself must be tested and adjusted by continuous research, both technical and practical, on organized lines, so that it is always "The Standard."

Determining the Standard

Failing a Government Engineering Bureau for the whole country, the engineering institutions would appear to be the best means to the desired end. An experiment in this direction has recently been made by the North-East Coast Institution of Engineers and Shipbuilders. The members and council have commenced on very conservative lines by preparing a guidance specification for triple-expansion engines for cargo boats, based on the best practice of the various specialized builders on the coast. It is proposed to begin on simple lines for this year, but an annual revision will be made in order that the specification may be gradually extended and kept thoroughly up to date, with a view to securing maximum rate of progress in technical advance, and commanding the confidence and promoting the ultimate interests of all concerned, viz., of the engine builder, the shipbuilders, and the shipowner. Other specifications on similar lines are to be prepared for quadruple engines, geared turbines and internal combustion engines.

Assuming that in the general problem of standardization this guidance specification of the North-East Coast Institution represents the best now obtainable, the next step is to provide means whereby there shall be progressive improvement by continuous investigation and research, supported by organized and collective practical experience. With re-

*From a paper read at the spring meeting of the Institution of Naval Architects, March 28, 1917.

gard to the latter, it is not sufficient that the engine builder gets rid of his goods on the day of the trial trip. There should be some system of co-operation between the engine builder and shipowner, whereby the general results in coal economy and costs for repairs over a prolonged period, certainly beyond the usual six months' guarantee, are recorded and rendered available. In order to secure the funds for carrying out this scheme, it has been suggested that the cargo boat engine builders of the North-East Coast should be invited to adopt the specifications at a small fee per horse-power. As the money so collected would be entirely devoted to promoting the progress of the associated industry, it is hoped and expected that there will be an enthusiastic response.

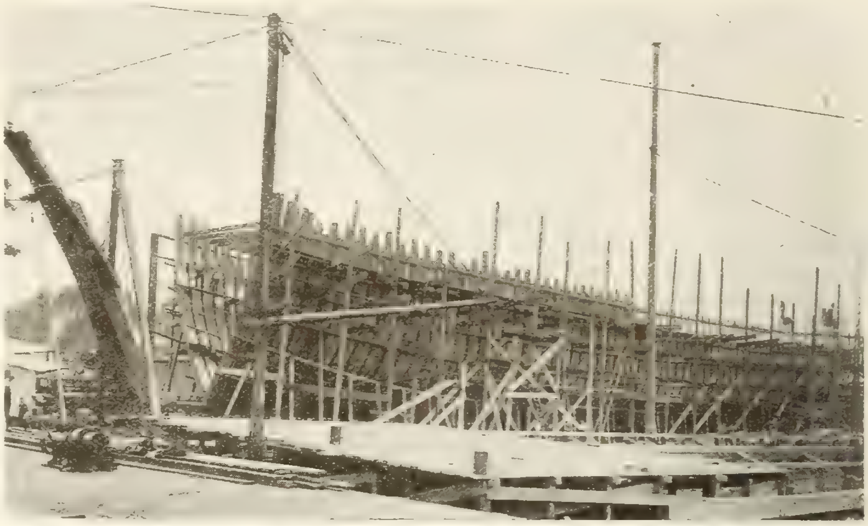
Auxiliary Machinery

In the matter of auxiliaries, the Research Committee appointed by the Council of the North-East Coast Institution will exhaustively test approved apparatus connected with a marine installation, and publish in their "Transactions" the results obtained. This will secure a reliable means of ascertaining the true performance of any apparatus so tested, and as the results will carry the hallmark of the Institution for accuracy, the value of the scheme to the industry generally is obvious. In the matter of boilers and shafting, complete standardization of marine machinery is blocked, because the Board of Trade, Lloyd's Registry, and the British Corporation issue independent rules, which are based on physical facts as a constant and individual opinion as a variable. Just a very little co-operation and mutual sympathy would enable all the existing differences to be adjusted to the great advantage of the many industries involved.

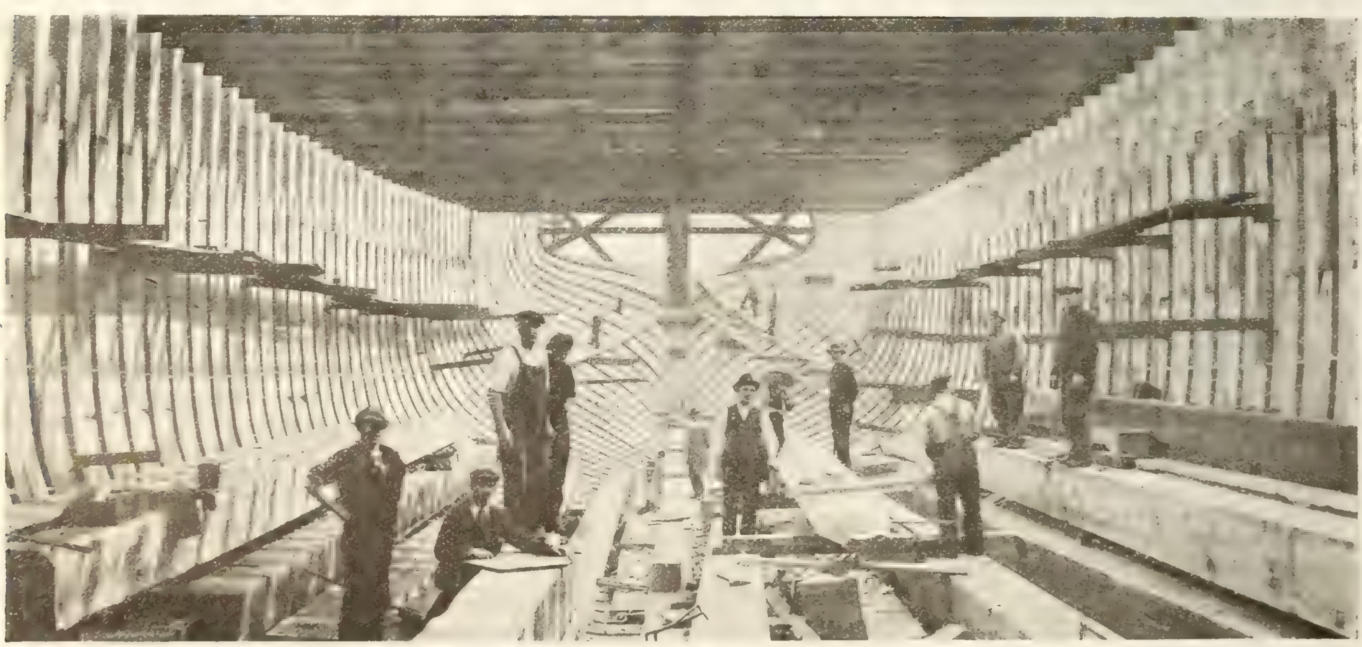
When Lloyd's Registry revised their rules some years ago, they requested the assistance of a committee of experts selected by the leading marine engineering institutions. This committee has been very successful, as the various members, all of whom occupy leading positions in the several shipyards and engine works, are in such direct touch with practice that their experience establishes mutual confidence, to the great benefit of all concerned. A similar committee of experts was appointed by these institutions about the same time, with the object of providing a means whereby the many irritating disputes and misunderstandings, which so frequently arose some years ago between the Board of Trade and the manufacturers, could be overcome, the collective technical experience of the members being available in the event of new rules being issued or old rules revised. Each member of the committee was prominently associated with a shipbuilding yard or a marine engineering works, and all gave their services with enthusiasm, although often at great personal inconvenience.

In any progressive country on the face of this earth except our own, such a committee would have been welcomed, and its expert capacity officially recognized and utilized to the fullest extent for the common good; but the traditional antagonism to innovation, no matter how desirable, has prevailed. For twenty years this committee has given of its best to the cause of progress. It has never received adequate recognition or encouragement from the Department of State it was appointed to assist. It is gratifying to record, however, that a serious attempt is now being made to devise some mode of procedure for making full use of the existence of this committee in the national interests.

Assuming the various surveys decide to harmonize their rules so that standard design, scantlings, and physical properties of material may prevail throughout the range of cylindrical boilers as now supplied to cargo boats, the economic effect on the manufacture of the material and the building of the boilers would be



AUXILIARY POWER SCHOONER "MARGARET HANEY" ON THE STOCKS.



INTERIOR OF HULL UNDER CONSTRUCTION, AUXILIARY POWER SCHOONER "MARGARET HANEY."

very pronounced. It would at once be possible to prepare a series of standard designs, with accompanying specifications for plates, furnaces, tubes, stays, rivets, etc. The steel manufacturer could estimate the probable demand, produce in bulk, and give immediate delivery. The boiler builder would be freed from the delays arising from the preparation and submission of designs, and would simply order from the scheduled list—receive the goods exactly when required, and proceed with the manufacture with an economic continuity hitherto impossible. The following are examples of divergence between surveys:—veys:—

Divergence in Boiler Rules

1—For a single-ended boiler, 15 ft. 6 in. mean diameter, 11 ft. 6 in. long, 180 lb. working pressure, thickness of shell 1 3/32 in., tensile 28½ to 32½ tons per square inch, diameter of rivets 1 3/32 in., pitch of rivets 9½ in.

Working Pressure of Shell

		Pounds.
Board of Trade	=	183
Lloyd's Registry	=	210½
British Corporation	=	204½

2—For the working pressure of a suspension furnace, 3 ft. 10 in. inside diameter, ⅝ in. thick:—

		Pounds.
Board of Trade	=	185.3
Lloyd's Registry	=	200.5
British Corporation ...	=	196.5

An examination of the tables of pressure for these furnaces reveals to the curious that for thicknesses below 9/16 in., the Board of Trade allows a greater working pressure, the thinner the furnace, than Lloyd's, and for furnaces over 9/16 in. thick Lloyd's allow a greater working pressure, the thicker the furnace, than the Board of Trade. Arbitrary requirements also often involve unnecessary cost, as, for example, limitation by the Board of Trade of rivet pitch to 10½ in. with a tensile of rivets of from 27 to 32 tons necessitates an increase in shell tensile for large boilers, for which abnormal extras have to be paid to the steel makers.

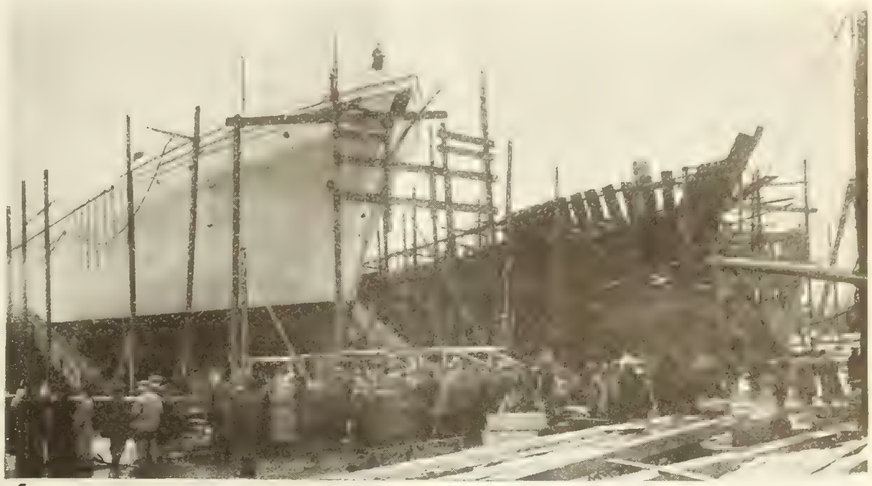
A brilliant example of what can be achieved by well-directed collective efforts is the standardizing of stationary boilers in the United States of America by a committee of experts appointed by the American Institution of Mechanical Engineers. In this connection the following extract from a speech by the late president of the Board of Trade would seem to be appropriate: "It will, in fact, be apparent to all close observers that a country which fails to regulate and foster its industries in the national interest cannot in the nature of things long survive the rivalry of another country where the industries are so regulated and fostered."

The Shafting Anomaly

The only detail of the engines proper affected by the surveys is the shafting, and the following is an analysis for a set of triple-expansion engines with cylinders 25 in., 41 in., 68 in., by 48 in. stroke and 180 boiler pressure:—

Diameter of Crank and Thrust Shafts

Board of Trade	=	12.76
Lloyd's	=	13.32
British Corporation	=	13.08



AUXILIARY POWER SCHOONER ON LEFT JUST PREVIOUS TO LAUNCHING.

Diameter of Tunnel Shaft

Board of Trade	=	12.12
Lloyd's	=	12.69
British Corporation	=	12.42

In determining the diameter of propeller shafts, each of the three surveys adopts a different basis. Lloyd's and the British Corporation consider the diameter of the propeller—the British Corporation the block coefficient of displacement of the vessel, whilst the Board of Trade consider neither. Assuming a propeller diameter of 17 ft. 6 in., and a block coefficient of displacement of .78, at four-fifths moulded depth, diameter of propeller shaft is by:

Board of Trade	=	13.47
Lloyd's	=	14.29
British Corporation	=	14.67

That is to say, a shaft to the Board of Trade requirements would be deemed 22 per cent. too weak by the British Corporation, and 16 per cent. too weak by Lloyd's. In practice the shafting of a cargo boat is practically never made to the rules of the Board of Trade, as when the machinery is built to the Board of Trade survey it is invariably associated with either Lloyd's or the British Corporation. If, therefore, these two surveys could see eye to eye, and bring their shafting rules into line, a great advance would be made towards completely standardizing the reciprocating engines of a cargo boat.

With the advent of the geared turbine, and its probable extended use in the near future, it might reasonably have been expected that the various surveys would at least have formulated rules on a common basis. Such, unfortunately, is not the case. Lloyd's and the British Corporation adopt shaft horse-power, the Board of Trade indicated horse-power; Lloyd's rule giving the larger shaft. This

AUXILIARY POWER SCHOONER "MARGARET HANEY" TAKING THE WATER.

state of affairs is perhaps not surprising in view of the fact that aloofness has hitherto been a national characteristic. Force of circumstances will compel us to modify this attitude, and to recognize that friendly co-operation will be the factor which will determine whether we sink or swim in the coming great race for industrial supremacy.

Industrial Methods Revolutionized

Broadly speaking, industrial methods in Great Britain have been completely revolutionized since the war began, because we have been driven to recognize the dominating influence of intelligently directed energy as a factor in the economics of production, and it is unquestionable that the magnificent response to the national demand for colossal quantities of war material resulted from the cultivation of intelligent effort and concentration of organized method. The actual ascertainment of what is possible has been accompanied by an industrial awakening after a dangerously prolonged sleep, and as a fortunate consequence we shall be immeasurably better able to face possibly perilous competition than ever before, provided we sustain our efforts and profit by our experience. Intelligent direction increases the useful efficiency of labor enormously, so that by concentrating on method, employing the most suitable equipment obtainable, and organizing physical effort, such a high rate of production can be obtained as to demonstrate without a shadow of doubt the certainty of an employer being able to pay high wages, but labor must respond with unrestricted production and enthusiastic co-operation. This does not mean great physical effort by labor, but reasonable and continuous effort during a full working day.

In this connection the war has revealed the high standard of useful efficiency attained by women, especially as workers of machine tools, and to their lasting credit be it said that the steadily progressive production in many munition factories is due entirely to the unceasing desire on the part of the women always to do their best. To obtain all that is commercially possible from standardized production it is necessary to manufacture continuously a given article in the best way by the best means at the best speed, whereby the efficiency of each factor is unity. The greater the number manufactured, the less becomes the percentage of attendant expenses. Therefore, in cases where the value of the article is con-

AUXILIARY POWER SCHOONER "LAUREL WHALEN" JUST AFTER SHE HAD LEFT THE WAYS.

siderable, and the demand great, the commercial success attainable may be phenomenal. Quantity is a controlling factor in all cases, so that maximum success in the standardization of marine engines can only be obtained by the cooperation of the greatest number of builders.

Classification of Propelling Machinery Parts

Merely as an illustrative example let us consider the position on the North-East Coast. The various engineers who specialize in cargo boat machinery produce collectively, say, 200 sets of reciprocating engines per annum. The following is a rough classification of the parts of the main engines only:—

MAIN DIVISIONS OF ENGINES

I—Cylinders

Cylinders	600
Covers	600
Liners	200
Pistons	600
Valves	600

II—Columns

Columns	1,200
Guide plates	600
Guide bars	1,200

III—Bed-Plate

Bed-plate	200
Bearings and keeps	1,200
M.B. bolts	2,400
M.B. nuts	4,800

IV—Main Forgings

Piston-rods	600
Connecting-rods	600
Main bolts	1,200
Cranks	600

V—Valve Gear

Excentrics	1,200
Excentric straps and reds	1,200
Radius links	600
Drag links	1,200
Reversing haft	200

VI—Condenser

Body	200
Doors	400
Water head	200
Tube-plates	400
Tubes	250,000
Ferrules	500,000

VII—Pumps

Air pump	200
Circulating pump	200
Feed pump	400
Bilge pump	400

AUXILIARY POWER SCHOONER "MARGARET HANEY" BEING TOWED TO BUILDERS' WHARF AFTER LAUNCHING.

Sanitary pump	200
Levers, etc.	400
Drag links	800

Taking the steel forgings and adding the thrust, tunnel, and propeller shafts, the approximate total weight would be about 14,000 tons. If this amount were concentrated at a convenient centre, the steel cast, the ingots forged, and the forgings rough turned, and if the works were of such size that this demand were only a portion of its output, then the cost of production would be so low as to enable the engine builders to buy cheaper and to sell cheaper. The destination of these forgings for machining would depend on available facilities and transport, the object being a continuity of operation under the most favorable conditions possible. The heavy castings would be produced from standard patterns, all prepared in consultation with the iron-foundry management, and the design being standard, the foundry management could with confidence provide the best labor-saving tackle. When delivered to the engine works the castings would be dimensioned by means of standard apparatus, and machined from continuous supply. The tens of thousands of engine valves, fittings, and other details would be classified and manufactured in bulk in specially equipped departments in the best ways, by the best means, and at a cost quite unapproachable by present methods.

Purchase, as Against Manufacture

In cases where an aggregation of parts is not sufficient to secure the benefits of production in bulk, those parts should be purchased from manufacturers whose business it is to produce such parts. For example, take condenser ferrules. A condenser ferrule machine can produce 400 per hour. Even if the yearly demand were half a million the machine would produce them in about 1,200 hours, or, say, 24 working weeks, thereby being operated at half its capacity. Complete standardized production of ferrules and similar details would involve the use of the greatest number of automatic machines that could be supervised by one skilled operator and one or more unskilled assistants. One skilled machine setter and three unskilled assistants could probably manage up to 20 automatics. Therefore, the difference between one machine working half its time with one operator and 20 machines working continuously with four operators is an indication of the possible savings by organized manufacture in bulk.

Take as another example the large bolts, such as are required for main bearings, piston rods, and connecting rods, and which would aggregate about 10,000 per annum. So great a number of practically similar articles would admit of the purchase of special turret lathes capable of finishing bolts up to 5 in. diameter, with provision for completing all operations from the first rough cut to the final screw-cutting and finishing, and if the number of machines were adjusted to maintain their full working capacity the cost of production would again be very favorable.

These few examples indicate the possibilities of standardized manufacture as applied to cargo boat engines. The system is co-operative, and is the direct antithesis in its inception and in its results to the destructive competition which has been so rampant and ruinous in past years. In manufacture, the day of conservative and scattered individual effort is over—it leads to certain ruin. Success lies only in concentration by collective effort and the pooling of individual interests for the common good.

AUXILIARY POWER SCHOONER "MARGARET HANEY" READY FOR SEA.

STRATEGIC VALUE OF CAPE BRETON ISLAND*

By F. W. Gray**

WHEN the French monarchs of the old regime selected Louisburg as the site of an impregnable fortress, proudly named the "Dunkirk of America," they had a proper conception of the strategic importance of the ISLE ROYALE, that outpost of Canada since known as Cape Breton Island. Who holds the Island of Cape Breton commands the Cabot Straits and the Gulf of St. Lawrence, and if that same power holds also the island of Newfoundland, the Gulf of St. Lawrence can be made a closed sea.

While the main ideas of naval strategy are the same in all times, yet to-day we think in terms of modern inventions. The advantages given to Cape Breton Island by its geographical positions are at this date enhanced by the presence of large bodies of coal developed to a producing stage, by the existence of large iron and steel works and chemical plants, and by the existence in connection with these industries of commodious harbors, equipped with facilities for loading and discharging cargoes, and by rail connection with the mainland.

*Paper read at recent annual meeting of Mining Society of Nova Scotia.

**Asst. to Gen. Mgr. Dominion Steel Corporation, Sydney, N.S.

The Coal Factor

It may be laid down as an axiom that no modern nation can retain economic independence unless it possesses within its frontiers a supply of bituminous coal. Bituminous coal is the motive power of modern civilization. It has been truly said—and by a German military leader—that victory in the present war will go to the nation that can mine and carbonize the largest quantity of bituminous coal. No form of deep mining can be prosecuted without coal, and the absence of coal will effectually limit the mining of all metals and minerals. Coal moreover is the source of the base of the most destructive modern explosives. Briefly, without coal the national armament would be limited to the weapons of the mediaeval knight. As this war and its preliminaries have abundantly demonstrated, economic dependence spells sooner or later political subservience.

The importance of Cape Breton Island is chiefly this: With the exception of a strictly limited deposit of bituminous coal on the mainland of Nova Scotia, the Island of Cape Breton and the submarine territory adjacent, contains the only supply of bituminous coal in Canada east of the region of Weyburn and Estevan.

Coal Spells Power

The national future of Canada, its maintenance of national integrity and political independence, is bound up with retention of possession of the coalfields of Cape Breton Island. This may seem a sweeping statement, originating in the mind of one who attaches undue importance to coal, but a little consideration of the present position of France, Italy, Switzerland, Norway, Sweden, Spain, Greece, and—to come nearer home—of Central Canada, will show that the statement is made advisedly. France and Italy would be impotent and defeated if it were not for the coalfields of Britain and the British Navy.

The position of the European neutrals

to-day is dictated by the source of their coal supply. The safety of the United States lies not so much in vast territory and population as in the possession of the richest coalfields of the world, so situated as to be far removed from the danger of foreign invasion. If Russia were not the possessor of coalfields she would be more helpless than Holland, more dependent than Denmark, because, and here is where the analogy interests Canadians, extent of territory, density of population and agricultural wealth are a menace only, if coal is absent. In these times coal spells power. It is a necessity of nationhood.

Is it therefore too much to say that if Canada wishes to fulfil the glorious promise of her future she must guard as a precious jewel that remote Island which saw the dawning of British power and British ideals on this Continent, and stands not only as a sentinel over the broad and ancient commercial highway of the St. Lawrence, but is Canada's chief treasure house and depository of coal, a substance greater in potentialities than all the silver of Cobalt, or all the gold of Porcupine and Yukon.

As the principal British naval base in North Atlantic waters, Halifax will always retain its pre-eminence, and it only needed the actual stress of warfare to restore to this Canadian port the lustre that had become dimmed by a long period of peace. It is an ice-free port, lending itself admirably to fortification and submarine defences, and its railway connections would be difficult for a hostile landing force to interfere with so far as the immediate hinterland is concerned. Of the two lines of railway that connect Halifax with Quebec and Montreal, one parallels the St. Lawrence river so closely as to be quite open to attack from the river, and the lower gulf. The capture of Halifax by hostile forces would not so seriously impair our national defences as would the hostile occupation of Cape Breton Island. Those who have followed the course of events at Zeebrugge, on the Belgian coast, will realize what the Bras d'Or Lakes could be made as a submarine base if they fell into the hands of an enemy, and the analogy between the Dardanelles and the Straits of Canso must have struck every military observer who has ever passed through the narrow channel dominated by the imposing bulk of Cape Porcupine.

Comparative Strategic Value

Imagine a geographical position which combines the strategic value of the Dardanelles and Gibraltar with the industrial importance of Pittsburg or Sheffield, and one has a fair and not exaggerated conception of what Cape Breton Island means to Canada, and conversely, one may deduce what nature the menace would assume were this island in enemy hands.

The potentialities of Cape Breton Island for defence or for offence in the hands of a resourceful foe, are less or greater according to the smaller or larger concentration of industrial activities in the island, and the time seems to have arrived when the Government of Canada must take this matter under consideration in all that bears on the future of industrial expansion in Cape Breton.

Take for example the suitability of Sydney Harbor for a shipbuilding plant. The advantages of this site are too obvious to necessitate their being set out in detail; the thing is self evident. A large ship-building industry in Sydney, with the provision of the dry-dock that would be a natural and necessary accompaniment, connotes at once adequate military and naval protection. Otherwise it will be foolish to multiply and concentrate still additional facilities in Cape Breton Island that would advantage an enemy in control of the island.

SHIP PLATE MANUFACTURE IN CANADA

CANADA will not be in a position to build steel ships in quantity for at least two or three years, according to a statement by Mark Workman, president of the Dominion Steel Corporation, on May 10. He added that scarcity of steel was the chief cause. Mr. Workman stated that the entire output of steel from the Dominion Steel Corporation plant had been contracted for by the Munitions Board up to the middle of 1918, and the chances now were that this contract would run into 1919.

Some criticism has been directed at the officials of the corporation because of the sale of a ship plate mill some months ago to American interests. Mr. Workman, when asked regarding this, explained that the plant sold was incomplete, and that it would be impossible to make ship plates from it. He pointed out that he thought it had been purchased some seventeen years ago, had never been operated nor installed. He added that a plant properly equipped to manufacture ship plates would require an expenditure of something like $2,500,000 and the plant sold had been purchased for $70,000.

Going further into the prospects of steel shipbuilding in Canada, Mr. Workman said that it would be an absolute impossibility for the Steel Corporation to operate a plate mill at the present time, even if they had one on the ground, because of their inability to secure raw materials. The corporation has a rail mill lying idle because sufficient ore cannot be obtained to operate it.

"The Canadian Government Railways, the Canadian Pacific and the Grand Trunk Railways are all crying bitterly for rails, but we can do nothing to help them as shell requirements just about exhaust our product," he said. To increase the steel output further, Mr. Workman explained they would have to start at the ore output from the mines. Additional furnaces would have to be installed, as well as new coke ovens. Work is at present being undertaken on the latter, and the corporation is spending this year something like $5,000 000 on extensions and improvements at Sydney, but this increased output is all provided for in contracts already made with the Munitions Board.

"These extensions will require a great deal of additional labor and it will be another question whether we can secure this or not," he concluded.

JAIL AND DEPORTATION FOR SAILORS

SEVEN months and a half in Bordeaux jail, to be followed by deportation from the country, was the sentence imposed recently by Judge Lanctot, on each of the three sailors of the steamship Cassandra, who were found guilty of endangering life, drunkenness and theft. The three of them, Charles Hyland, Frank Morgan, and William French, were each given six months for having endangered life. Morgan and Hyland will have to serve six weeks more for trying to broach the cargo, while French was given an extra six weeks for broaching the cargo and stealing eighty-four bottles of Scotch whiskey valued at $120.

Judge Lanctot was most severe on the three prisoners. He said that they were devoid of all human principles, and he could find nothing that would recommend them to clemency. His Honor stated that on account of the war and the submarine menace, there was great danger of disaster, and the loss of life and property through the conduct of the trio. They had acted in such a manner that they had no claim for clemency. He contended that they had no respect for life or property, not even their own lives, and were indifferent to what might occur. The only defence they had to offer, was that everyone on the ship being drunk, which could not be possible or the ship would have never reached port. His Honor said that they could not even offer the poor excuse of drunkenness, for when they were sober, they stole. They could not screen themselves behind the excuse that they were the worse for liquor. He told the trio that they were the most low and degraded human beings that had ever been brought before him. They knew the conditions that existed at the present time, both on land and sea, and exhibited no sense of patriotism whatever.

Before sentencing the three sailors, Judge Lanctot said that he was dealing with them under the British Seamen's Act, as the Cassandra was registered in Glasgow, Scotland. For that reason he thought it best to apply the British law instead of the Canadian law. The trio were from the Old Country, to which they will be returned, after they have served their sentences, and he thought it best to deal with them under their own law.

Morgan, French, or Hyland did not have a word to say while Judge Lanctot was delivering his judgment, and pronouncing sentence. Their counsel, Mr. Jules Delorimier, asked Judge Lanctot if he was dealing with the prisoners under the British or Canadian law, but did not state whether or not he intended to carry the case to a higher court.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

DRINKING WATER PROBLEMS ON OCEAN VESSELS

By "Marline Spike"

THE ordinary person on shore who is accustomed to water taps in the house or a well in the yard, has little conception of the value of fresh water. "You'll never miss the water till the well runs dry" is an old but true saying, and if any man proves it by daily experience, that man is the foreign-going seaman.

A cargo ship pays if she carries sufficient cargo, so it is obvious that any other deadweight will be cut down to a minimum quantity compatible with the prospective voyage. To prevent "Jack" from turning into a pillar of salt, the law allows each sailor three quarts of drinking water per day on the ocean. This allowance has to serve all purposes. If one expects coffee for breakfast, soup for dinner, and tea for the evening meal, then one must hand over such quantities of water to the cook that are required to make these liquid foods. Then so much must go into the drinking barrel or "breaker" as Jack calls it.

The Long Voyage Feature

The writer is speaking of long voyage sailing ships, and not of coastwise or passenger vessels. The question naturally arises, how do you get along on such a small allowance? This query can be answered only by those who have gone through the mill, and I would say again, no one knows the value of fresh water more than an ocean sailor.

Say that we leave Halifax, N.S., for New Zealand in a windjammer. With average winds, this trip may spin out to 14,500 miles, and many good vessels take 120 days to make the passage, the vessel even if small will carry 20 hands "all told," and there is no positive assurance that she will call in at any port on the road. In fact, bar accidents, she will not. Something like 2,600 Imperial gallons will be this vessel's allowance for the New Zealand run, and every drop of it is looked after with the same care that a chemist shows when making up a prescription.

Dealing Out the Daily Allowance

Every afternoon on the passage, the 2nd mate "whacks" out the water, generally at 8 bells or 4 p.m. This individual is perhaps the only man known to keep a portable pump in his room. The fresh water pipe leads up from the iron tanks in the vessels hold and a threaded brass cap comes flush with the deck. Here the pump is installed for fifteen minutes daily and the eagle eye of the officer sees that no one gets more than he should. If there are ten men in the fo'c'sle the man who is attending to that particular mess will get about 8 gallons. Buckets or pails, used for this purpose only, are marked with their gallon capacity by a known line near the top.

If the boy's mess consists of three youngsters, they will get 2½ gallons per day. The cook draws the allowance for the captain, mates, steward, and himself, while the petty officers, boatswain, carpenter, and sailmaker, get their regulation amount. Where the cook has Scotch blood in him, a pint of water from each mess is demanded for "boiling in," otherwise the Dr. (cook's nickname), will refuse to dole out in tea, coffee or soup the amount given him for such purposes. The vapour argument is sometimes very funny, for sea-cooks are never known to be angelic in disposition.

In ordinary North Atlantic weather, the allowance of water is not a cause of suffering but, in the tropics when the sailors are sweating with rope hauling, the amount is not sufficient. Then what about washing? As a rule a sailor on these long runs will try to wash twice a week, but failing that, he will manage it on Sundays. Our great salvation is in the torrential doldrum rains at the Equator, or in the rainy (SW), monsoons of the Indian and China Seas. In any of these places at certain seasons, ships can refill their tanks and washing and scrubbing are the chief occupations for a few days.

Where vessels have to be abandoned in mid-ocean the question of carrying drinking water in the small boats is a serious one, and shipwrecked seamen have to go on as little as a pint a day, and even less in extreme cases.

Drinking Water Problem in Harbors, Rivers, Etc.

Then we have drinking water problems in harbors, rivers and roadsteads. Take for instance a vessel in the Rio de la Plata or as sailors call that river of South America—"The Plate." There is no finer drinking water in the world. Although this river is muddy in appearance and even stays discoloured after a settling process, it can be drunk straight from the owner. Sarsaparilla grows on the low islands that are a feature of this giant waterway above Buenos Ayres.

Now take the Hoogli at Calcutta, India, it would not be considered safe to take drinking water from that great river because some native tribes persist in throwing their dead on the bosom of these sacred waters. Thousands of coolies drink the water from the river at Calcutta, but that is no criterion. A native can do many things that the white man can't do. If forced through peculiar circumstances to take water from such rivers, a treatment by permanganate of potash would follow. Sometimes alum is used, but boiling the water is the only safe method, and in such places as Bombay and Karachi, when these ports were full of bubonic plague, the drinking water was very carefully attended to.

When in the nitre ports of Chile, South America, the fresh water problem is as much a shore feature as it is a ship one. From Coquimbo to Arica there is not a stream fit to drink, as the ground is impregnated with saltpetre. Iquique has a pipe system that brings drinking water to the coast from an inland lake but many of the small ports have to depend entirely on distillation from the ocean water by mechanical means. When places were opening up or in their initial stage on this interesting coast, the drinking water had to be brought by vessels, either from Peru or from Valparaiso.

In a great many of the world's roadsteads, vessels are watered by barges that carry a certain quantity of the drinking fluid in tanks made for the purpose. When this barge moors alongside of the vessel a force pump conveys the water into the big ships tanks. It will be easily seen then how indifferent persons can allow dirt of various kinds to get into the water. If we get to the bottom of our tanks on a long passage where rain has not favored us, it sometimes becomes imperative to use an improvised filter. This is made from a coal oil can; the square five gallon kind. A few very tiny perforations are made in the bottom, covering a one inch radius. A layer of pebbles and sand alternately use half the can up, then a few pieces of white bunting tied over the open mouth makes the filter ready. This contrivance is certainly crude, but it gathers up the dirt wonderfully, and can be secured over the bung of the water "breaker," the clean water finding its way through.

Tropical Disease Due to Bad Water

As a general rule the majority of tropical diseases are contracted through water, although it is not always necessary to drink the infection. Take swamp-fed malaria in Central America, or yellow fever in Rio de Janiero, Brazil. The first mentioned disease rises from the rivers after night fall and can be likened to a mist rising some ten or twelve feet high. In Rio de Janeiro both yellow fever and smallpox can be got out of the bay bottom on ships anchor chains. The germs of these dreadful maladies are in the mud and ooze of the Boca anchorage. About 20 years ago when the writer first visited these parts, the port of Santos (a coffee port), was in an epidemic stage of yellow fever through new ground being

excavated for dock accommodation. At the time both Rio and Santos had vessels lying at anchor with every soul on board dead. In many other ways it could be shown how much a sailor is interested in drinking water, healthy rivers and anchorages.

The ocean cries out "water, water everywhere and not a drop to drink."

HARBOR MASTER CELEBRATES 25th ANNIVERSARY

CAPTAIN BOURASSA, harbor master of Montreal, celebrated the twenty-fifth anniversary of his official connection with the port, early in the present month. On May 2, 1892, Captain Bourassa was appointed deputy harbor master, Henry Bulmer being at the time chairman of the Harbor Commission. Subsequently on the decease of Captain Howard, for many years the harbor master, Captain Bourassa was appointed acting harbor master, a position he filled for some time. In June, 1914, after twenty-two years' service, Captain Bourassa was appointed by the Dominion Government to the office of harbor master of the port of Montreal in succession to Captain Demers. There is no better known figure in shipping circles than Captain Bourassa, who practically all his life has been connected with the shipping interests, having been, previous to beginning service with the Harbor Board, captain for many year of the steamer Laprairie, of the Montreal-Laprairie service.

Commemoration Function

In commemoration of the anniversary the members of the harbor staff were the guests of Captain Bourassa at a gathering at his home on Cherrier street, when a pleasant time was spent. The harbor master's health was honored and the hope was expressed by all that he would be spared for many years to continue his valuable services to the port. Madame Bourassa was not forgotten, being the recipient of a gift of flowers from the harbor staff. A handsome gold-headed cane was presented to Capt. Bourassa on behalf of his associates in the harbor work by Major David Seath, and speeches were made by Brig.-General Labelle and H. A. Lemieux, father of Hon. Rodolphe Lemieux, and an old friend of the Captain. Most of the speakers referred to the fact that Capt. Bourassa has nine sons and four daughters living. One son, Gaston, is at the front.

Changes Since 1892

In response to the toast of his health, Captain Bourassa referred to the many changes that have taken place since he began service with the port. "A quarter of a century," remarked the harbor master, "is quite a long period, and many changes have taken place in that time. The port of Montreal for instance, has had a wonderful development during that period. There are not a great many who were associated with it a quarter of a century ago who are with it still. When I began my service, the port was under the old system of direction, being governed by a board composed of representatives of the various public bodies, appointed for a certain period. Of that board Mr. Henry Bulmer was chairman, and Alexander Robertson, secretary. Captain Howard was the respected harbor master. With the exception of Mr. Robertson, all of these gentlemen, as well as many of those who were associated with them at the time and subsequently, have passed away after rendering valuable service to the shipping interests of the commercial metropolis.

"The port of Montreal twenty-five years ago was not what it is to-day. The total tonnage in 1891, the year previous to my beginning service, was only 938-657 tons, while last year it was 2,261,374 tons. These figures alone will give

CAPTAIN T. BOURASSA.

some idea of the striking development that has taken place in the port. The development of facilities and the great advance in improvements, thanks to the policy of the respective governments, and the work of the successive harbor administrations, have kept pace with the development of the increase in shipping. Twenty-five years ago there were no high level wharves or no permanent sheds such as we have to-day; now we have a harbor that is admitted to be one of the finest equipped and best administered on the American continent, if not in the world. In this work you have all helped by your loyal and faithful services. As far as I myself am concerned, all I can say is that I have always tried to do my duty to the utmost of my ability. Like others I have had my hard days, my days of disappointment, but I may say that I never lost heart, and never relaxed in my duty, and I am proud to bear testimony to the fact that the faithful service of a quarter of a century has had its reward. It would be ungrateful on my part if I did not express my warm appreciation of this.

Spirit of Co-operation

"It is only just that I should add a special word of praise for the present harbor board, and I do so with the greatest pleasure. W. G. Ross, the chairman, and his two colleagues, Farquhar Robertson and General Labelle have been, and are, indefatigable in their efforts for the welfare of the port of Montreal, and the relations betwen them and the members of the staff are of the most pleasant kind. There is in fact, a spirit of loyal co-operation and bon camaraderie between all connected with the harbor, which means a great deal in the success of our efforts.

"My personal relations during the years of my service, not only with my associates of the harbor board, but with the shipping and commercial interests, with the sailing masters, in fact with all concerned in any way with the port, I may say, have always been of the most pleasant character, in fact these years have been the happiest and most enjoyable of my life, and my hope is that the next quarter of a century will be as happy and as pleasant.

The gold-headed cane presented to Captain Bourassa bears the inscription, "To Captain T. Bourassa, harbormaster, Montreal, 1892-1917."

Letters of regret from W. G. Ross, chairman of the Harbor Commissioner, Farquhar Robertson, Harbor Commissioner, and Sir John Kennedy, consulting engineer, said appreciative things of the Captain's services. Among those present to honor their colleague were Brig.-General A. E. Labelle, harbor commissioner; Major David Seath, secretary; M. P. Fennell, assistant secretary; F. W. Cowie, chief engineer; T. F. Trihey, cashier; Geo. Smart, comptroller; Robert A. Eakin, paymaster; John Vaughan, traffic superintendent; Geo. Andron, superintendent of the fleet; J. A. Masse, superintendent of shops; Capt. Coleman, chief of police; L. H. A. Archambault, purchasing agent; Duncan Stuart, assistant paymaster; J. Nahen, superintendent of elevators; T. W. Harvey, assistant chief engineer; L. E. Mercier, assistant superintendent of terminals; John Boyd, H. A. Lemieux, Stuart Hurtubise, Walter Weir and Raoul Sorreau.

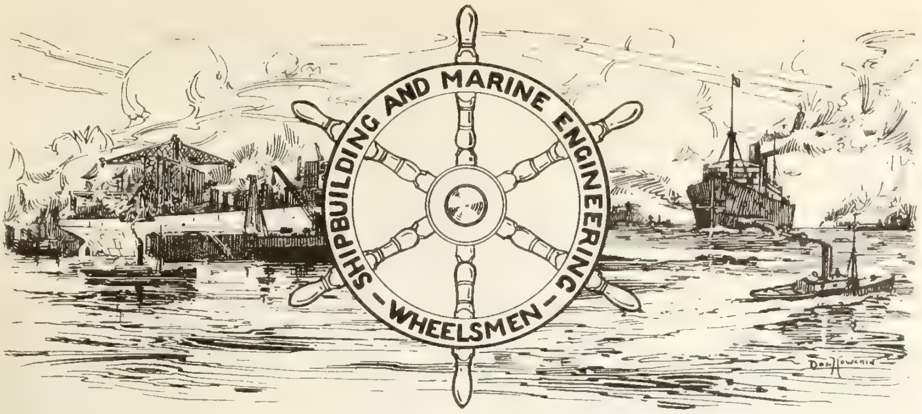
A prospective husband met a young married friend one day and asked him how he managed about addressing his wife's mother. Said the prospective husband. "It is going to be a difficult matter for me to address any woman as 'mother' except my own mother. How did you do it?"

"Oh," said the married friend, "I called her 'say' the first year, and after that I called her 'grandma.'"

Little Bobby—Dont you want to take me to the toboggan slide with you some day, Mr. Jinks?

Mr. Jinks—I never go to any toboggan slide, Bobby: never saw a toboggan.

Bobby (a trifle nonplussed)—That's funny, I heard pa say something about your going downhill at a furious rate.



The success of shipbuilding and marine engineering enterprise is largely dependent on its "Wheelsmen." This series of articles has for its object the featuring in a racy, interesting and instructive fashion, the personal training, experience and achievement of those who to-day in Canada are energetically and effectively navigating the twin craft to higher degree prominence in their capacity as designers, constructors, outfitters, etc.

WILLIAM NEWMAN

SOME years ago, when a certain shipbuilding yard in the States was making fame for itself through the construction of fast Atlantic liners, it was related of the principal partner that he could go into any department of the plant and replace any workman himself. This thoroughness of training was the formation and mainstay of a particularly close understanding between management and employees, and the almost unique record for efficiency and freedom from trouble in the plant referred to was largely due to the conditions mentioned. Those of our readers acquainted with William Newman, works manager and naval architect of Polson Iron Works, Ltd., Toronto, Ont., will recognize in his interesting career a striking parallel to the conditions related in the opening paragraph. To have developed an intimate knowledge, through personal experience, of all stages in lake shipbuilding from dock newsboy to manager of one of Canada's largest shipbuilding plants is the meantime measure of our Spoke's accomplishment.

Born in Kingston, Ont., Oct. 31, 1873, the son of William Newman and Mary Dehaney, the subject of our sketch early developed that inborn love of boats which was to ultimately influence his life in such large measure. While still at school the attraction of the water was so great that his spare time after school hours was spent in selling papers on the mail boats and other craft with which the waterfront was thronged. With the finish of school days, life's serious work had to be decided on, and accordingly at the early age of 13 years, the "call of the deep" was temporarily suppressed when an apprenticeship was commenced in the Canadian Locomotive Works in his native town. From 1886 to 1890 the duties of a machinist were discharged with considerable ability but even the four years spent in the shade of locomotives did not alter the destiny of our young friend, the "lure of the lake" being so irresistible that immediately his machine-shop apprenticeship was finished he went back to the boats and started to serve his time as an apprentice shipwright in the shipyards of Capt. Robert Davis and the Montreal Transportation Co.

His ability in marine matters was so marked that in the short space of three years he had advanced to the position of foreman in the latter Co.'s yard, a post which he held from 1893 to 1901. The experience which Mr. Newman thus obtained during the receptive period of his life was later to prove of particular value in equipping him for the discharge of ever-increasing responsibilities. During the last six years of this time he did submarine diving for the M. T. Co., and the Donnelly Salvage & Wrecking Co., raising, dry-docking and repairing boats.

WILLIAM NEWMAN.

From 1901 to 1903, Toronto was the scene of his labors as foreman with the Bertram Shipbuilding Co., which position he resigned in order to accept that of superintendent for the late Frank Simpson, C.E., public works contractor, for whom he had charge of laying the six-foot conduit from Lake Ontario to the tunnel under Toronto Bay. All of the floating plant required for this contract was designed and built by him.

On the death of Mr. Simpson in 1908, Mr. Newman became superintendent of the Polson Iron Works, and three years later made a tour of the important shipbuilding plants in Great Britain, France, Belgium, Holland and United States. In the same year, 1911, he was promoted to the post of works manager, and in 1913 undertook the additional duties of naval architect. Mr. Newman looks forward with considerable gratification to the near future when the launching of a number of vessels will mark the completion of the half century of launchings under his supervision, the first of the fifty being the Earl King, launched in 1909.

Notable amongst the work executed during the tenure of his present position are the designs for the big dredge Port Nelson which was built in four months, also the stern-wheel steamer and three steel steam lighters for the Government work at Port Nelson, Hudson Bay. A surpassing effort which is expected to materialize in the near future, however, is a 500-foot electrically operated, steel floating dry-dock, which is to be constructed for the Polson Co.

Mr. Newman's activities further include the managership of the Canadian branch of the American vessel fire register; while he is a member, Naval Architects and Marine Engineers Association, New York; associate member, Institute of Naval Architects, London, Eng.; hon. member, Canadian Society of Marine Engineers; member, Toronto Board of Trade; hon. member, Canadian Quoit Club. He is the possessor of a gold medal presented by the council and citizens of his native city for saving the lives of two women from a burning building while a volunteer member of the fire department, Oct. 2, 1897, and also wears the Diamond Jubilee Medal awarded to representatives of Canadian troops in England on that occasion. His military service includes a twelve-year membership of the 14th Regiment P.W.O.R.; on the outbreak of war he was granted a commission in the 23rd Regiment Northern Pioneers, and is now Captain of No. 5 company.

Mr. Newman owes his success to a large extent to hard work and close attention to details believing in the old adage that it is the little things that count. This principle he has applied to his work with conspicuous success. Some years ago Mr. Newman had the good fortune to meet the late Sir Wil-

liam White the celebrated naval architect, and was much impressed by his personality and kindly advice received on several occasions. Our "Spoke" advises all budding marine engineers to study the career of some man prominent in his profession and considers that no better incentive can be found than in the life of Sir William White, one of whose chief characteristics was a mastery of detail.

While he may deny the fact, our "Spoke" owes not a little of his success to a genial and thoughtful temperament fostered by a study of human nature. During the early part of his career, his occupation gave him plenty of opportunity for observing his fellow men. The knowledge gained has been a valuable asset since, particularly in his present position where he has charge of a large number of men. It is said that when Polsons began to get busy again some eighteen months ago, many old hands who had left when business became slack, returned immediately from all parts on hearing that there was work for them at the old shop. This in itself speaks well for the firm and those in authority.

Mr. Newman being essentially a practical man believes in the practical end of the business. At the same time he strongly advocates the acquisition of the theory of attendance at night school or college and also by the reading of technical books and journals. He holds that this is necessary for a proper and intelligent understanding of one's calling, the combination being of material assistance to all engaged in the construction of ships, or their machinery, either in the shop or in the drawing office. In his younger days, Mr. Newman spent practically all his spare time on study and is deeply indebted to Frank Simpson, for whom he worked at one time, for much valuable assistance and encouragement. He also attended evening classes at Wells Business College, Toronto.

Mr. Newman also states that "there is no institution in Canada where naval architecture is taught, all marine draughtsmen being brought here from Great Briain, Sweden, Denmark and the United States. I think some of our Universities should have a chair in Naval Architecture, as they have in the University of Glasgow and in the School of Technology in Boston, as at the present time, such important positions as loftsman, ship's plater, and ship's carpenter are practically closed to Canadians. There are scarcely a dozen apprentices in Canada to these departments, and outside of the "Old Guard" of ship's carpenter, 90 per cent. of our skilled labor in these branches are brought from outside the Dominion.

"Another industry which Canada must soon take up is the manufacture of ship plates and shapes; also of seamless steel tubes and corrugated furnaces. With her immense wealth of ore, nickel, copper and coal, and her unlimited supply of timber in British Columbia, I see no reason why Canada should not in the future become independent in the shipbuilding trade—something which she is far from being at this writing."

SAVING STEEL IN SHIPBUILDING

IT is interesting in connection with the United States big shipbuilding push to learn that in mercantile shipbuilding, before she declared war, no fewer than 140 ships were ordered on the Isherwood system of construction. They represent a deadweight carrying capacity of 1,344,000, and it is estimated that the saving in steel by adopting this system is 40,000 tons.

Within the last few weeks, J. W. Isherwood, the patentee of the system, has received further requests to proceed to the States in connection with the construction of standard ships; and Japan, which is taking up the same idea, will afterwards be visited by Mr. Isherwood at the request of shipbuilders in that country. It is noteworthy that 700 ships have been built, or are under construction, on this system despite the fact it was only introduced a little over eight years ago, and it claims, we believe, 95 per cent. of the oil tank vessels now being built throughout the world. Mr. Isherwood, who is comparatively a young man, was formerly a member of the technical staff of Lloyd's.

Of considerable importance is the fact that out of a total of 672 ships which have been built on the Isherwood system, and which represent a total deadweight carrying capacity of 5,200,000 tons, the enormous amount of 150,000 tons of steel has been saved, as against what would have been required for the construction of the ships in the ordinary way. It is estimated by a well-known naval architect that if the Government should give out contracts for 200 ships, by adopting the Isherwood system 34,000 tons of steel could be saved.

YARROW'S LTD. TAKE STERN WHEELER CONTRACT

YARROW'S LTD., shipbuilders of Esquimalt, B.C., have been awarded a contract for the construction of another steel sternwheel vessel, and are expecting soon to sign up contract for a fourth boat, all of them being for the same concern which ordered the two already built by the firm. If the fourth order comes along it means that Yarrows, Ltd., will have two of these steel boats under construction in their yard at the same time, which will add considerably to the general activity in shipbuilding on this coast.

The vessels are to be employed on river service in India. They are 132 feet in length, 32-foot beam, with a draft of three feet, and have accommodation for passengers and freight. They will be capable of making a speed of ten knots. The boats themselves are shipped, knock-down, to India via the Blue Funnel boats leaving Victoria, the pieces being marked and placed in crates so that when they reach their destination it is a more or less simple matter to rivet the parts together.

All the machinery equipment, including engines and boilers. is being manufactured at the Yarrow plant on the Clyde, being shipped to India from there. The first vessel built in Victoria by Yarrows, Ltd., was shipped across the Pacific on one of the Blue Funnel liners some time ago and the second one is all ready to be shipped on the next sailing of the Blue Funnel liner Protesilaus.

In these days of steel shipbuilding, it is a very difficult matter to get the steel for the smallest sized vessel. The major portion of that used in the construction of these river boats is being secured by Yarrows, Ltd., from the United States. That further orders are being placed here for these boats indicates the satisfaction with which the owners have viewed the work turned out.

SUBMARINE CONSTRUCTION ON PACIFIC COAST

CONSIDERABLE interest is taken in Vancouver's latest acquisition in the way of shipbuilding contracts, particulars of which were recently announced. J. V. Paterson, of Seattle, former president of the Seattle Construction & Dry Dock Co., and one of the best known shipbuilders and marine architects on the Pacific Coast, has closed contracts to build six submarines for the Russian Government. The work will be done at a plant which Mr. Paterson has built in Vancouver, and actual construction of the submarines has been started. Material for all of the half dozen is already on the ground and the plant practically completed, with a force of 150 men now at work. This force will be increased immediately to 350 men, as, while the definite dates of delivery of the vessels are not given out, Mr. Paterson states that they are wanted as quickly as possible.

The order for the submarines is the largest for war vessels for a foreign power yet placed on the Pacific Coast, and is believed to be the only one now pending in Northern yards. A year and a half ago Mr. Paterson built five submarines for the Allies, but he states that these later craft are of a larger and more powerful type than the former order.

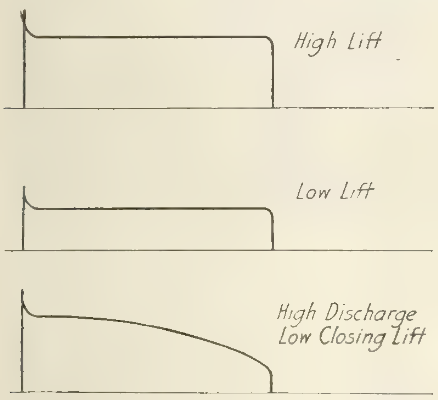
AUTOMATIC electric generating plants have been adapted for use on ship board, recent events having shown the desirability of such installations. The type adopted is that in which the generating set starts up automatically immediately the main ship's supply fails. Arrangements are also made whereby the set switches itself into operation once every 24 hours, so as to indicate its continued state of preparedness.

Development Towards New Type of Steam Safety Valves*

By George H. Clark **

The article presents in outline the theoretical considerations governing safety-valve action, and gives a record of experimental work done in the development of a new type of safety valve. In discussing the new type of valve here presented, actual diagrams of valve action have been introduced, together with results of capacity tests of sufficient duration to insure accuracy. An attempt is made to show that the efficiency of valves may be increased materially by using the proper design of seat, and that with two regulating rings instead of one as is usual, variations of advantageous character may be introduced into the valve action.

In order to develop a safety valve of high discharge capacity at the greatest possible efficiency, and with the least possible weight of valve per pound of discharge, it is clear that, for any given diameter of valve seat, the one



FIGS. 1, 2, 3. DIAGRAMS OF LIFT CHARACTERISTICS.

giving the greatest lift will have the greatest discharge capacity if the seat angles are equal, and, with equal lifts and equal diameters, the flat seat (at right angles to perpendicular axis) is the most efficient. The flat seat was adopted at the start, due to its greater efficiency and to other considerations to be mentioned later, and effort was directed toward methods of increasing the lifts, at the same time retaining all the advantageous factors obtaining in low-lift valves.

The two most serious objections to high-lift valves are the shock produced at closure and the tendency to lift water. There has been almost endless discussion over these points, resulting in more or less misunderstanding. The shock of closure depends on the height from which the disk drops to its seat and the velocity with which it is moving at the time it seats. By reducing the height from which the disk drops, the shock may be reduced so that the valve having an enormous lift after popping may close without shock if that lift decreases gradually with the receding pressure until it becomes small at the point of closure. This point has been very clearly brought to the experimenter, although no record is available, since the shock cannot be measured.

The second objection to high-lift valves, that of lifting water, is in reality less serious. It is useless for anyone to say that this objection is unfounded, because the tendency to lift water is almost entirely dependent upon the capacity of the valve, and the higher the lift the greater the capacity. It must, however, be remembered that every steam boiler has a certain required safety-valve capacity which is the same for all classes of valve, so that for proper relief the total capacity of the low-lift installation and the high-lift installation is one and the same. Now if the capacities are the same, the velocities in the boiler nozzles are the same, and one has no greater tendency than the other to lift water, since the rise in water level is due to velocity toward the nozzle. The two objections spoken of above may exist in high-lift valves, if, in the first case, the valve lacks the proper action, and in the second case if judgment is not used in the installation.

The results of shock are injury to the boiler and a short valve life, and if felt necessary this may be avoided, not by eliminating the high-lift valves, but by legislating against their bad feature, high closing lift. The lifting of water seldom occurs with stationary boilers, and it can be prevented by the proper choice of valve nozzle and of discharge capacity per valve. Fig. 1 shows the characteristic of certain high-lift valves which are objectionable, due to the high closing lift. Fig. 2 shows that of a low-lift valve in which the high closing lift has been obviated at the expense of discharge capacity. Fig. 3 shows the characteristic of an ideal valve having high capacity and low closing lift, and this was decided upon as the aim of the investigation.

Relation Between Discharge and Pressure Under Valve Disk.

In order to investigate the subject thoroughly, it is necessary to take into account two forces which produce valve action, not the least important of which

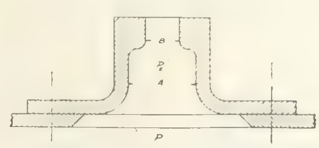


FIG. 4. REDUCTION IN AREA OF PASSAGE BETWEEN BOILER AND VALVE.

is the variation in pressure on the spring-load area of the disk—in other words, the pressure which exists below the disk in advance of and during the period of blowing. By means of certain assumptions we can apply the formula of flow proposed by Napier, and after the calculations are made they may be tempered by the actual conditions which exist, should they deviate from the assumptions.

Steam in the course of its passage

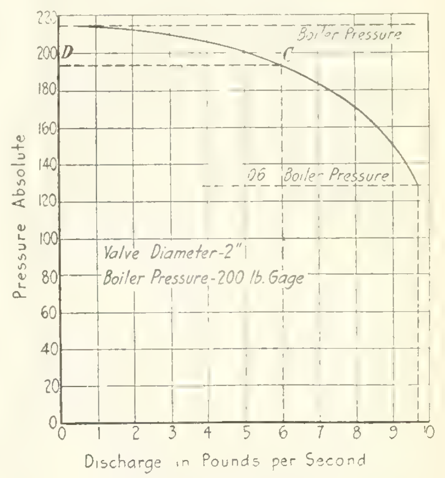


FIG. 5. RELATION BETWEEN PRESSURE UNDER DISK AND WEIGHT OF STEAM FLOWING.

from the boiler to the atmosphere encounters two reductions in area of passage which affect the pressure under the disk, one at entrance to the valve or the nozzle, and the other at the seat. The existent area conditions may be graphically represented by Fig. 4, in which the reduction of area from boiler to valve is denoted by the section at A, and over the seat by the section at B. The edges of the passage which form the approach to the section at A are rounded to a radius equal to the diameter of the passage, in order that the formula used may fit the case at hand. Let P_1 represent the boiler pressure, P_2 the pressure under the disk, and then assume that by some means the area at B can be changed as desired. When flow is established and conditions have become constant, the weight of steam passing the section B is the same as that passing the section A, and if the weight passing B is varied, that passing A goes through the same variation. Now the pressure P_2 depends on the weight flowing and the pressure P_1. Assign a constant value to P_1, say 200 lb. absolute, and by means of the following formula calculate the pressure P_2 with different weights flowing. So long as the discharge capacity at B is less than that at A, the formula

$$W = 0.029\, a \sqrt{P_2}\, (P_1 - P_2)$$

holds. When P_1 is assumed to be constant the formula may be written:

*From paper presented at annual meeting of American Society of Mechanical Engineers.

**Instructor in Mechanical Engineering, Massachusetts Institute of Technology.

$$\therefore P_2 = \frac{P_1}{2} + \text{or} - \sqrt{\frac{P_2}{\ } - \frac{W}{(0.029\ a^2)}}$$

after the quadratic equation has been solved.

Assume now, for an actual case, that the diameter at A is 2 in., giving an area 3.1416 sq. in., and that P_1 is equal to 200 lb. absolute boiler pressure. Then calculate different values of P_2 with different weights flowing. These values of P_2 may be plotted against the weights, and the curve shown by Fig. 5 will result. This curve is interesting, since it represents quantities which may be arrived at by calculation only, and which must exist. Its significance is as follows:

With a safety valve of 2 in. nominal diameter and adapted to discharge a certain weight of steam, the pressure under its disk may be found from the curve in the following manner: Suppose its discharge is 6 lb. per sec.; then the points C and D are located and the pressure under the disk may be read. It is clear then from this curve that the pressure under the disk varies as the weight of flow varies; and that for valves of low lift the reduction of pressure is not great, but that for high lifts it increases rapidly. This curve is discontinuous when the pressure under the disk reaches a point where it is equal to 0.6 × boiler pressure, under which condition the area at B has become equal to that at A; the pressure P_2 is the minimum possible, and to all intents and purposes we have a standard orifice, so-called, the characteristics of which are shown by Fig. 6.

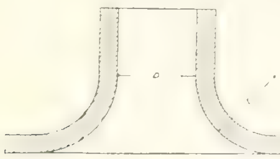


FIG. 6. STANDARD ORIFICE.

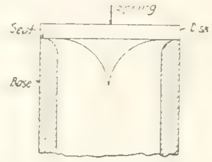


FIG. 7. VALVE INCORPORATING STANDARD ORIFICE EQUIVALENT.

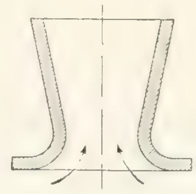


FIG. 8. ORIFICE WITH PRESSURE BEYOND THROAT VARYING INVERSELY AS AREA.

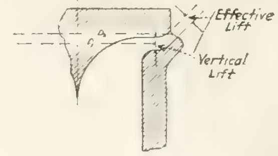


FIG. 9. VALVE WITH MAXIMUM PRESSURE BETWEEN LIPS.

Our only assumptions up to the present are the neglect of friction and the rounded edges. It is clear that friction and square edges will tend to increase the drop in pressure, since both tend to reduce the discharge capacity of A, and it also follows that maximum capacity is not available with square edges at A. In other words, the full advantage of the hole in the boiler is not available unless this hole has rounded edges.

There results from the further consideration of the curve in Fig. 5 a simple explanation of why a safety-valve disk settles back after the first sudden pop. Since the reduction of pressure on the disk does not take place until the valve is open or until flow is established, the lifting force is, at opening, that due to full boiler pressure and, the instant flow is established, this is reduced and the disk must necessarily settle back to a position of equilibrium. The design of a valve must then incorporate means to provide lifting force outside the seat area, to make up for the reduction of upward force on the load area due to drop in pressure over and above that necessary to compress the spring.

In any safety valve there are three factors which affect the rate of flow over the seat, and which are characteristic of the seat itself. They are vertical lift, seat angle, and the contour of the passage which approaches the seat. The flat seat is adapted to open the largest area per unit of vertical lift, and hence should be employed, all other things being equal. Since the approach to a standard orifice makes the throat sectional area 100 per cent. efficient, the characteristics of such an orifice should be employed. Professor E. F. Miller, of the Massachusetts Institute of Technology, was first to round the edges of a safety valve in order to increase the efficiency of discharge per unit of lift, and in so doing took a long step in the direction of high safety-valve efficiency. The valve shown in Fig. 7, in which the standard orifice (or better, its practical equivalent), is incorporated, follows the theory proposed by him several years ago. The full benefit of the standard orifice would be available, regardless of the type of lip provided, if the passage area from the seat outward increased; but to produce a high-lift valve the maximum available pressure between the lips consistent with maximum discharge must be used.

Steam Flow as Affected by Shape of Orifice

A consideration of the pressure conditions within a standard orifice, of which Fig. 6 is an example, will give valuable information. In this type of orifice the area of each section beyond the throat section is equal to that at the throat section; and it has been found that at the throat section and at each section of equal area thereafter the pressure is very closely equal to 0.6 × boiler pressure, and that the back pressure into which this orifice discharges has no effect on either the weight discharged or the existent orifice pressures unless this back pressure exceeds 0.6 × boiler pressure. If it does exceed 0.6 × boiler pressure, the discharge capacity is reduced and the pressure throughout the orifice is increased. With the orifice of a shape shown in Fig. 8, but of equal throat-sectional area, the weight discharged is the same as before, but the pressure after the throat section varies inversely as the area.

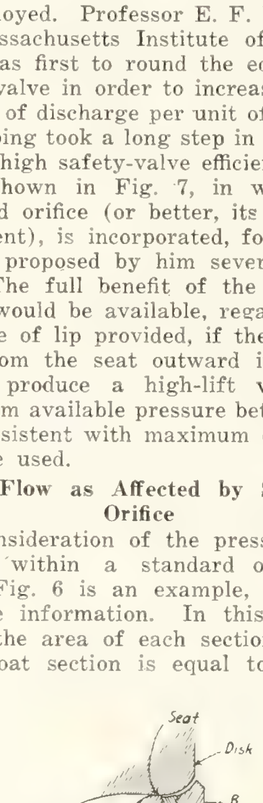


FIG. 10. VALVE ADJUSTABLE FOR VARIABLE LIFTING FORCE.

It follows from the above consideration that in order to produce maximum pressure between the lips there must exist at full lift an equality of area at each section outward from the throat of the orifice which is located at the seat. Since the effective disk diameters are constantly increasing, the effective lift must be reduced as the passage is lengthened. This can be done by giving the passage an upward slope, as shown by Fig. 9, which illustrates graphically the reduction of effective lift with increasing diameters such as D_1 and D_2, at which the vertical and effective lifts are measured.

If a valve of the above characteristics is constructed and blown, it will be found to have an extremely high lift, and the opening of such a valve is so sudden as to be truly explosive. A very large percentage of the pop lift is sustained if the popping pressure is held constant, and when such a valve starts to blow down, the lift gradually decreases during the blow-down period until a certain point is reached where the pressure becomes such that the valve disk drops suddenly to closure. This construction will produce a blow-down which is likely to be a third of the boiler pressure, and forces its designer to incorporate means of regulation which will give a small blow-down without interfering with the capacity or other features of valve action.

Regulation for Warning and Blow-down

The question of adjustment presents the real difficulty in safety-valve design. Means for regulation should in general perform their functions with as little effect as is possible on the lift and, per unit of lift, should produce no effect on the discharge capacity. Other than lift the two functions to be controlled by regulation of the variations in lifting force are warning and blow-down. A valve which chatters or vibrates at the instant of opening, or sizzles at that time, shows a lack of lifting force at low lifts, and one which shows an excessive blow-down demonstrates that the lifting force at low lifts is too great to allow of closure, and it follows that the requirements of warning and blow-down are somewhat combative. If possible the regulation of one should be made independent of the other. Blow-down is an absolute necessity on the spring-loaded type, due to the existence of lifting force outside

the spring chamber, and it is clear that attempts to reduce the blow-down will tend to decrease the lift and relieving capacity. In general, the real secret in the

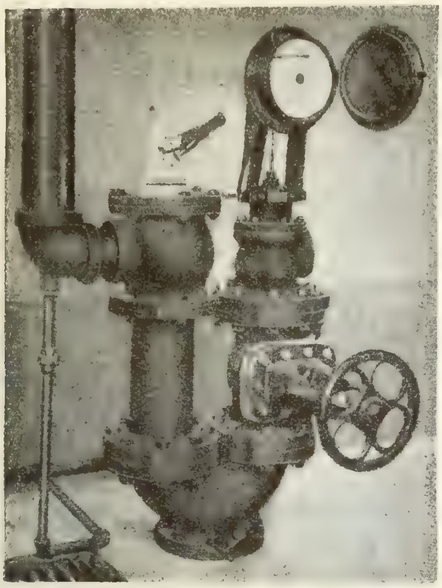


FIG. 11. VALVE ARRANGED FOR TEST.

design of a perfect safety valve lies, not in the production of excessive lifting force, but in controlling and adjusting it; the action of a valve is dependent, not on the quantity of lifting force, but on variations of lifting force with discharge capacity and pressure.

Design of New Valve

Fig. 10 shows a valve having means for adjustment which are based on the production of variable lifting force as stated above. The two annular rings shown at A and B carry on their upper surfaces curves which approximate in shape the curve of the disk. The inner ring A, which I choose to call the warning ring, is threaded upon the base of the valve just outside the flat seat and carries, threaded upon it, the ring B, which is adapted to control the blow-down. These rings may be lowered away from the disk, or given what I choose to call initial clearance.

Now it is clear that if both of these rings are lowered an extreme distance, when the valve tends to open no lifting force will be available. If the ring A is raised to a position near the valve disk,

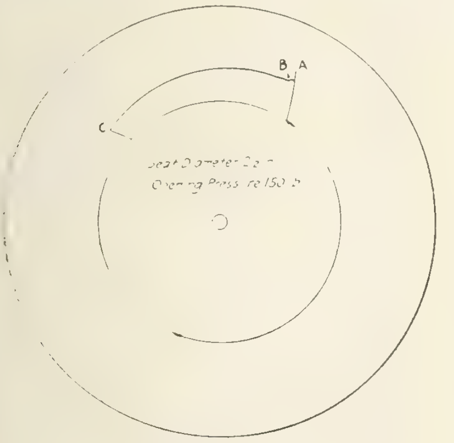


FIG. 12. PERFORMANCE CHART OF 2½ INS. EXPERIMENTAL VALVE.

a lifting force will be provided which will depend (1) on the pressure produced between it and the disk and (2) on the extent of the disk area on which this pressure acts. As was shown in the discussion of the standard orifice, the pressure depends on the area of the passage, and the area in the valve is a function of the initial clearance and the shape of the curve. These factors are built into the valve to produce the desired result, which is to provide lifting force at small lifts to overcome excessive warning; and it has been found that with the proper shape of ring, on its initial clearance depends the warning of the valve. Since this warning ring alone produces only small lifts, it has no appreciable effect on the blow-down.

Again, as the blow-down ring B is raised from its lowest position, there is a tendency to build up pressure between it and the disk when the valve is open, which tendency increases as the disk is approached. If a reasonably large clearance is left, it is clear that this ring produces almost no lifting force at low lift, since the area of the passage along this ring is large in comparison to that over the seat; and it follows also that, as the disk lifts, the effect of its initial clearance on the area of the passage becomes less and less as lifting continues. This can be illustrated by a simple calculation. Suppose that, measured at the extreme outside edge of this ring, the initial clearance is 0.03 in. and that the angle at this point is 45 deg.; then if the disk lifts 0.1 in. in a vertical direction, the height of the passage over the seat will be 0.1 in., and at the extreme edge the increase in passage height perpendicular to the curves will be 0.07 in., since with a 45-deg. angle the vertical lift is only seven-tenths effective—so that the total height of the passage is 0.1 in., the same as that over the seat. Suppose now that the lifting continues; the area at the edge of this ring gradually approaches that over the seat and can be made to become equal to it by proper design at any chosen lift. It is clear then that for all of the initial clearance of the rings, we have at full lift gotten back to the area conditions of a standard orifice.

Tests of this valve prove the value of this method of regulation, in that all the requirements of practice are afforded by it for all of the high lifts. Any one sufficiently interested can lay out a valve of this type, and he will find that if the characteristics of the spring to be used are known, he can calculate with reasonable accuracy the lifting force at any lift and also an approximate value of the total lift. In calculations of this nature the reduction of pressure on the spring-load area, as previously explained, must be taken into consideration.

Diagrams Showing Performance of Experimental Valves

I have with some difficulty succeeded in getting some diagrams from valves under service conditions which, I believe, show in detail the results of the methods of regulation which are employed. Fig. 11 shows the arrangements of the valves for testing. The tests from which the diagrams were secured were carried on at the power plant connected with the new buildings to be occupied by the Massachusetts Institute of Technology.

One of the regular 4-in. valves was removed and a Y-base substituted in its place; the regular 4-in. was then placed on one of the branches and on the other was placed a special by-passed gate valve and finally, on top of this, the valve on test was connected. Under the above conditions the valve on test was well above 3 ft. higher than the top of the drum. Those experienced in safety-valve action will realize that this height is apt to seriously affect the action of the ordinary valve. The recording apparatus used consisted of a clock motion adapted to turn a chart once in 15 minutes. Bearing on this chart was a pen rigidly connected to the spindle of the valve and adapted to leave a record thereon of lift with respect to time, the lifts being multiplied by a ratio of approximately four to one.

Fig. 12 shows a chart of the performance of a valve with a 2½-in. seat. This

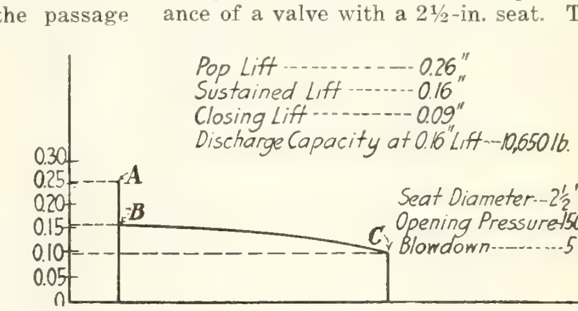


FIG. 13. ANALYSIS OF DIAGRAM SHOWN IN FIG 12.

valve was blown at 150 lbs. gauge boiler pressure and showed, under the existent regulation, 5 lbs. blow-down and almost no warning. In order that it may be clearly understood, it has been transferred to a diagram having rectilinear axes, on which is plotted the scale of lifts which resulted from the calibration of the recording lift gauge with an accurate micrometer. In Fig. 13 the sudden pop lift is shown at A, and the corresponding sustained lift at B. The variations in lift at the point B are further evidence of the readjustments of pressure which determine the pop and sustained lifts, an idea of which may be gained from the theoretical considerations previously stated in this paper. The discharge capacity of this valve was such that the popping pressure was not maintained, and the curve from B to C shows the reduction in lift, which in this type always corresponds to a reduction in boiler pressure. At C the valve closed suddenly, with less than half its initial sustained lift prevailing.

In other words, the drop lift of this valve, which is numerically 0.09 in., is about equal to that of a low-lift valve, while its discharge capacity at popping pressure is nearly twice as great as regards lift, and is even more when seat angle and efficiency are taken into ac-

count. This diagram shows the action of the valve when adjusted to give action somewhat similar to that to be found in some types of valves now procurable, and is in a good many ways ideal. Attention is called to the smoothness of the curve between B and C as evidence of

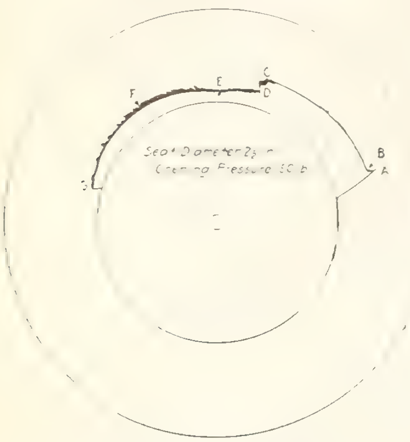


FIG. 14. PERFORMANCE CHART OF VALVE OF FIG. 12 WITH BLOW-DOWN RING LOWERED.

the equilibrium between lift and boiler pressure existent as the boiler pressure is reduced.

Fig. 14 shows precisely the same valve with its outside or blow-down ring lowered slightly. This diagram, like the one preceding, is reproduced from a photograph of the actual diagram, and has not been transferred to rectilinear axes because of the difficulty in showing the fluctuations in lift. The section of the curve at A shows the pop and sustained lifts as before. From B to C is shown the gradual reduction of lift corresponding to decreasing boiler pressure, until the point C is reached, where the disk suddenly falls from a reasonably high lift to a much lower one. This action is due to the large initial clearance of the blow-down ring, which throws it out of action entirely when the lift valve at C is reached. The fluctuations in lift at the point C show the lack of equilibrium at this point in the action, which results finally in the drop to the lower lift. At the lower lift, represented by D, all the supporting force is that due to the inner or warning ring.

The downward slope of the curve from D to E shows the tendency of the valve to decrease its lift with decreasing pressure, and closure would doubtless have taken place at D, had not the fans been started at this point in an attempt to force the pressure back to the popping pressure. The section from E to F shows an increase in lift corresponding to the increase in pressure. The fluctuations in lift during this period show a tendency of the blow-down ring to come into action, it being prevented from doing so only by the lack of pressure. The fans were shut off without orders at F, and the valve immediately blew down and closed with 0.04 in. closing lift at G. If we suppose the diagram to have been completed by closure at D, as would have been the case without the fans being started up, we would have a high-lift valve with a closing lift less than that obtainable from any low lift valve of ordinary design. That this action can be and is continually repeated by valves of this type is a fact to which every one who has been a witness of the blowing of this valve will testify. To those who have heard such valves blow, no diagrams are necessary.

It was decided after the two preceding diagrams were secured to change to a smaller valve of lower discharge capacity, under which the pressure could be regulated as desired. It is my purpose to bring out by the three diagrams which follow the faculty this type of valve has to respond, under ordinary conditions of regulation, to accumulated pressure. above the opening pressure. The new Boiler Code rules, if put into force, will allow 6 per cent. accumulation of the pressure, and I wish to show by the diagrams what advantage may be taken of this accumulation.

Fig. 15 shows a chart taken from a 2-in. valve in which the pressure was not allowed to accumulate. The low closing lift in comparison to the sustained lift is to be noted. Fig. 16 shows the same valve with an accumulation of pressure over the opening pressure of 4 per cent. This is under the same regulation conditions as the next preceding chart. The substantial increase in lift and corresponding discharge capacity is to be noted, together with the same closing lift.

In Fig. 17, the valve was regulated to give a low sustained lift, and was then given the full 6 per cent. accumulation. It is clear that the lift at B is more than 10 per cent. greater than at A, so that the discharge capacity at 6 per cent. accumulation is more than 100 per cent. greater than that at the opening pressure. The low closing lift is to be noted as before. The blow-down on this valve was about 2 lbs., so that the chart was made between a maximum

FIG. 15. PERFORMANCE CHART OF 2-INCH VALVE. SUSTAINED LIFT AND LOW CLOSING LIFT.

pressure of 159 lbs., and a minimum pressure of 148 lbs. The New Boiler Code specifications rate valves on their sustained lift at the popping pressure, and so it is clear that with this type the basis is amply safe.

In presenting the diagram shown in Fig. 18 for consideration, I believe I am bringing forward one of a safety valve which is absolutely new, both in conception and results. It has been the aim of safety valve designers to produce a valve which relieves a boiler with an

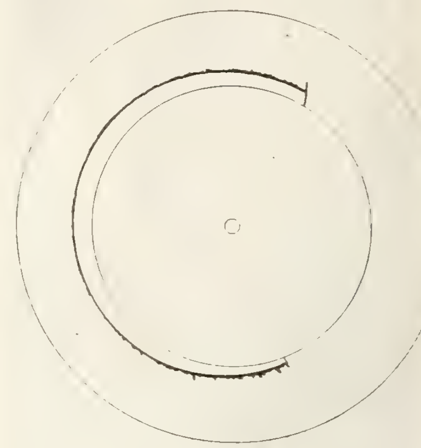


FIG. 16. PERFORMANCE CHART OF 2-INCH VALVE. PRESSURE ACCUMULATION BETWEEN OPENING AND CLOSING.

action that is smooth, while embodying as few sudden flucuations in pressure as is possible. The Boiler Code Committee recognized the exhibition of standard valves to respond to accumulated pressure by incorporating the 6 per cent. accumulation rule. The ideal safety valve for practical purposes is, I believe, one in which a reasonably low life is maintained at the popping pressure, but one which will on the slightest accumulation respond with an extremely high lift to take care of the emergency. If a low lift is available at the popping pressure for ordinary relief, a low blow-down may be incorporated, the condition imposed by absolute safety being that at slightly above the popping pressure the lift will have increased to such an extent that any possible emergency will be taken care of.

Fig. 18 shows a diagram from a valve which produces the above action, and is what may be called a second-opening valve. Many of this type have been built, and it has been found that with the proper regulation of rings, all valves having two rings will produce this action in modified forms. Imagine, first, one of the ordinary type blown with the outside ring removed. This would result in a low lift and a very low blowdown. Now suppose that the blowdown ring is in place, but that it is given such a large initial clearance that the valve will act, provided that it has sufficient capacity to relieve the boiler exactly as before, yet if it has not the required capacity the pressure will accumulate and the increase of lift resulting with only the inner ring in action will finally bring the outer ring into action, and a second pop will occur. This pop will result in a high lift, with corresponding high discharge capacity, and the valve size may be proportioned to give the required safety.

That this action can be accomplished in actual practice is shown by the diagram in Fig. 18, which resulted from the action of a 1¼-in. valve on a boiler,

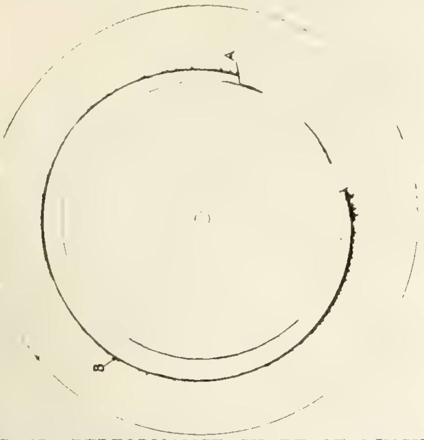


FIG. 17. PERFORMANCE CHART OF 2-INCH VALVE. LOW SUSTAINED LIFT WITH PRESSURE ACCUMULATION.

or rather boilers, of sufficient capacity to produce the required accumulation. The first pop and sustained lifts are shown at A, the sustained lift being very slow. The increase in lift between A and B finally results in the second pop, shown at B, which is the result of accumulated pressure. Between B and C the lift gradually falls as the pressure is reduced, until at C the outside ring goes out of action and the disk drops to a low lift, which is at the given pressure just sustainable by the inner ring. As the pressure is reduced the lift decreases, and after a slight blow-down the valve closes at D with a very low closing lift. This valve had a seat diameter of 1¼ in. and lifted at its highest sustained point about 0.11 in. This lift was the result of about 4 per cent. accumulation, and the calculated discharge capacity is 5,100 lb. per hour, which is approximately 170 boiler h.p.

Features of Design

Careful design will allow of bringing the second pop down very near the first one, and the limits of regulation may be so built into the valve by limiting the possible up and down movement of rings, so that this second pop will always come within a given range of pressure. This type of action has many advantages to recommend it. The absence of sudden excessive changes in relieving capacity and the low lift at closure are evident from the diagram. It is clear that if a boiler had two valves of this type, the second might be set to blow at a pressure corresponding to the point O on the diagram, so that the two valves would be able to handle the boiler at all ordinary times without the second pop, but in the case of emergency both would rise to the second pop lift. The installation would then be essentially a low-lift installation, but woud have all the advantages of high lift in the case of emergency.

Discharge Tests

In the course of the experimental work very few discharge-capacity tests could be run, since most available plants have no means of measuring the water used. Four tests were run at Annapolis, Md., at the United States Naval Experiment Station, which establish the fact that the standard orifice type is nearly 100 per cent. efficient in discharge capacity per unit of lift. The first three tests were made early in the experimental work, the fourth being run at a later date. The reported results of these tests are shown in Table I.

Test No, 2, when compared with the other tests, shows so low an efficiency that it obviously includes some error in the reported data, so it seems fair to assume that the efficiency is very nearly 100 per cent., or, in other words, within the limits of the experimental error in a test of this nature.

TABLE I.—RESULTS OF DISCHARGE TESTS ON VALVES OF THE NEW TYPE.

Test No.	Valve Diameter, In.	Opening Pressure, Lb. per Sq. In., Gage	Blowing Pressure, Lb. per Sq. In., Gage	Percentage Accumulation	Discharge, Lb. per Hour	Efficiency, Per Cent.	Lift, In.
1	2.5	150	158.8	5.86	17,325	99.43	0.252
2	2.5	200	212.9	6.44	16,892	78.88	0.238
3	2.0	200	203.4	1.70	10,176	101.57	0.145
4	3.0	248.5	248.5	0.00	24,182	96.26	0.204

It is always interesting to compare the results obtained from any piece of apparatus with those which we know to be theoretically possible. In the case of safety valves the full-opening valve serves as a convenient basis of comparison, in that its capacities may be calculated without reference to the type of valve used. If we attach a standard orifice to a boiler we have then the most efficient way of discharging steam, and this on a basis of throat diameter may be characterized as the full-opening valve.

In line 1, Table II., are shown the capacities of full-opening valves of several diameters figured directly from Napier's formula. Line 2 shows the discharge capacity of valves of the same diameters as read from the table in the recent A. Soc. M. E. Boiler Code. I have assumed that these values represent standard conservative practice. Line 3 shows the discharge capacity of the type of valve which I have described, and is the result of calculations involving the sustained lift as measured from the diagrams at the popping pressure.

FIG. 18. PERFORMANCE CHART OF A SECOND OPENING VALVE.

It seems reasonable to believe that the spring load of a safety valve is to some extent a measure of the shock at closure, which may be expected. Since all valves of the same diameter have approximately the same spring load, some other basis than diameter must be chosen for comparison. Discharge capacity is the first requisite in all valves, and so the spring load has been calculated per 100 lb. of steam discharged per hour. Line 4 shows the spring load per 1,000 lb. discharge of full-opening valves, which is, of course, constant. Lines 5 and 6 show the same quantity calculated for Am. Soc. M. E. valves and for the proposed type. Lines 7 and 8 show the percentage of full opening attained by the two available types.

There is reason to believe that we shall soon have boilers which will operate at 600 lb. pressure. Consideration of some of the values given in this table is interesting in this connection. A 4-in. valve set at 600 lb. pressure will have a spring load of approximately 7,540 lb., or about 3½ tons. Now if a 2-in. valve can be constructed to give twice the lift of the 4-in., it will have the same discharge capacity, but its spring load will be only one-quarter as great, or 1,885 lb. In other words, the discharge capacity varies as the first power of the diameter and the lift, but the spring load, which is independent of the lift, increases as the square of the diameter. It seems clear from this that high-pressure boilers will of necessity require small-diameter high-lift valves.

TABLE II.—CALCULATED CAPACITIES OF FULL-OPENING VALVES.

Opening Pressure, 150-lb. Gauge.

Nominal Valve Diameter, In.	2	2½	3	3½	4
1 Discharge capacity of a full-opening valve, lb. per hr.	26,600	41,600	59,900	81,600	106,500
2 Discharge capacity of A.S.M.E. valves (from table), lb. per hr.	2,529	3,613	5,419	6,954	8,670
3 Discharge capacity of proposed type (from tests), per hr.	5,310	10,640	15,400	......	......
4 Spring load of (1) per 1000 lb. discharged, lb.	17.7	17.7	17.7	17.7	17.7
5 Same for A.S.M.E., lb.	185	204	196	208	218
6 Same for proposed type, lb.	88.5	69.2	68.9	......	......
7 Percentage of full opening attained by proposed type	26.6	25.6	25.7	......	......
8 Same for A.S.M.E.	9.51	8.67	9.05	8.50	8.15

Table II. shows the net result of the development in spring-loaded safety valves, and serves to emphasize the opportunities which may be grasped by the designer.

The question of the effect of back pressure in the casing of a safety valve has been much discussed. It has been said that it may operate in two ways to reduce the discharge capacity. First, the effective lifts may be reduced, and, it has been held that back pressure reduces the efficiency of discharge of the orifice. If any of the disk area is exposed to back pressure the lifts will be reduced to some extent, but consideration of the theory of flow through an orifice, and particularly a standard orifice, brings out the fact that as long as the back pressure in the casing is less than 0.6× boiler pressure, the discharge of the orifice is not affected.

The discharge-capacity tests made some years ago by P. G. Darling, mem. Am. Soc. M. E., went some distance in establishing this fact, although no general conclusions were drawn. It remained for a section of a Committee of the American Society of Refrigerating Engineers, with Prof. E. F. Miller, Mem. Am. Soc. M. E., as chairman, to establish this fact beyond question. In refrigeration installations long discharge pipes are required, and the pipe friction produces so much back pressure that either the ordinary type of valve is useless or its discharge pipe must be of an excessive size. Experimental work resulted in a valve which was so constructed as to take advantage of back pressure to increase its lift without in any way having its discharge

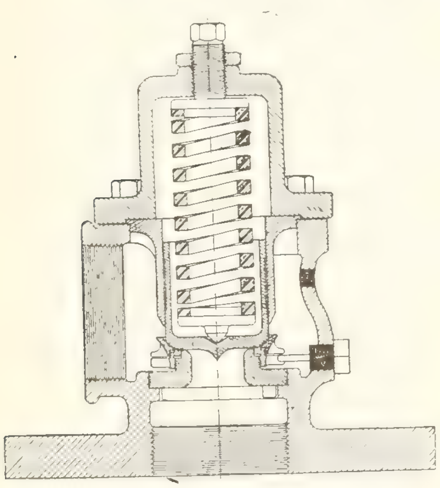


FIG. 19. STEAM SAFETY VALVE OF APPROVED DESIGN.

capacity per unit of lift reduced. That valve was due to the ingenuity of F. L. Fairbanks, Mem. Am. Soc. M. E., of the Quincy Market Cold Storage and Karehouse Co., and has been adopted as the standard in Massachusetts for refrigeration work. The possibility of working with back pressure operates to reduce the discharge pipes to reasonable sizes in spite of their length.

Examples of the New Valves

Fig. 19 shows a complete view of a valve which has the desired advantages. In the first place, valves of high lift, and by that I mean higher lift than any of those obtainable at present, must be guided from above, as guides in the base will cause too great a drop in pressure on the disk area. In this view the disk is made in the shape of a hollow piston, which is guided by a cylin-

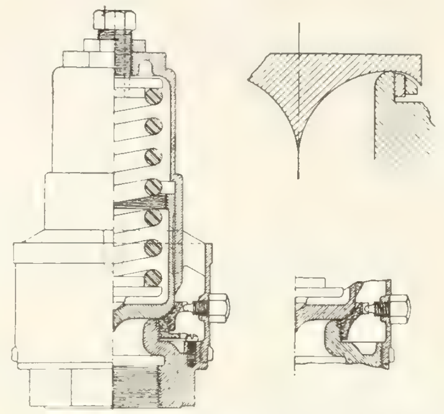


FIG. 20. LOCOMOTIVE VALVE OF APPROVED DESIGN.

drical sleeve that encloses the spring chamber. The fit existing between these is extremely loose, and no attempt is made to prevent leakage by the disk. This loose fit insures that the disk will not bind because of expansion or contraction between the members due to temperature changes, and is long enough in relation to the diameter of disk so that it will never cock. Its looseness alone insures that the disk will come to a uniform bearing on the seat, and it has been found that under no conditions of back pressure has the leakage by it been sufficient to produce pressure in the spring chamber, which is vented. With this type, the back pressure may be built up to nearly 0.6× boiler pressure without hampering the discharge capacity in the least, and since the back pressure is a result of the effective opening of the valve, it has no effect whatever on regulation if it is brought about by the means shown.

In the case of duplex or triplex valves having a common discharge pipe, the opening of one will tend to open the other, due to the exposed area outside the seat and the impossibility of back pressure acting downward on the disk. It must be understood that the commercial types of valves which are shown in the following illustrations are not dependent on back pressure for any part of their action, but are in every case adapted to work with it without harmful effect. Fig. 20 shows a locomotive valve of approved design, and Fig. 21 the proposed marine type of exceedingly large capacity.

Having shown a valve in which there is substantial increase in discharge capacity over those in use at present, and having demonstrated that this may be accomplished with lower closing lifts than are now the rule, attention is called to a possible improvement in this type. It will have been noted by this time that in all the types shown the passage turns upward from the seat region, and it is also clear that so far as the area conditions go it might as well be turned downward, the area conditions remaining constant, as illustrated in Fig. 22, but there will be available as lifting force a factor which would act upward on the disk, and which is commonly known as a jet action. Some few valves of this type have been constructed, and the results gained have been convincing of their possibilities. Enormous lifts have been attained with the same absence of shock at closure as is the case with valves herein described. The problem has been by no means solved, but advances have been made in a direction which tends to indicate that it will be solved finally, and will result in enormous discharge capacities per inch of valve diameter, with the same efficiency per unit of lift. It is clear from a consideration of the diagram that the force due to jet action will not be destroyed by back pressure, as the velocity of the issuing jet of steam is a function of the orifice pressure, which pressure is not affected by the back pressure.

In closing this paper, attention is directed to the fact that this valve is not essentially a high-lift valve. It may be designed to give low lifts as well as high lifts, and is easily adaptable to the proposed Am. Soc. M. E. specifications. It will, of course, under the specifications, benefit by reason of its flat seat and by a discharge capacity about 30 per cent. greater than the 45-deg. seat now in common use.

I have shown that it is possible to produce a valve of high lift as regards discharge capacity and low lift as regards the shock at closure. This one

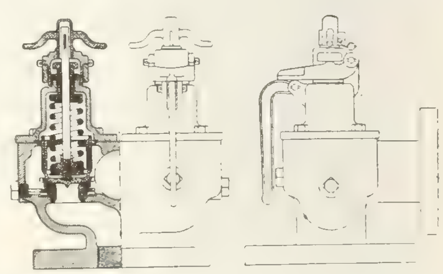


FIG. 21. MARINE VALVE OF APPROVED DESIGN.

feature alone removes the most serious objection to high lift. It is clear that for all of the reasonably high initial lift the valves have a marked faculty to respond to over-pressure. Finally, high-lift valves must come into general use, as the safety requirements in boiler practice must be more economically met than is the case at present. It is distinctly the province of the experienced and unbiased engineer to lay down the rules that will govern future safety-valve installations, but in determining the rules the valves must be considered on a basis of discharge capacity and action rather than lift.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

COMBINED STEAM TURBINE AND CENTRIFUGAL BOILER FEED PUMP

THE tendency towards displacement of the reciprocating boiler feed pump by the centrifugal pump furnishes a good example of the necessity resting upon manufacturers of machinery for sustained technical development. Since it must handle a comparatively small amount of water against a relatively great head, the centrifugal boiler feeder should be fitted with small diameter impellers running at high speed. It is therefore well adapted for steam turbine drive. Fig. 1 shows an early steam turbine-driven boiler feeder built in 1910 by the De Laval Steam Turbine Co. The two-stage pump has a capacity of 1,600 gals. per minute against 700 ft. head at 2,800 r.p.m., and upon test gave an efficiency of 60 per cent. The pump is entirely independent of the turbine, a coupling being interposed between the pump shaft and the turbine shaft, and it could therefore have been driven just as well by electric motor or by rope or belt as by a steam turbine.

The unit, however, realized the advantages peculiar to the centrifugal boiler feeder, viz., reliable and uninterrupted service with little, and often unskilled attention, absence of pulsation, shock, water hammer, vibration, or over pressure in pipe lines, elimination of relief valves, suitability for use with automatic boiler feed regulators acting independently at each boiler and with feed water meters, close governing, either by speed governors or by pressure governors, freedom from injury by overloading, lightness and compactness, accessibility, elimination of valves, packings, sliding surfaces and air chambers, small upkeep and attendance expense due to simplicity and few wearing parts, lower cost of maintenance of piping system, small consumption of oil, efficiency, and in the turbine-driven type, ability to use superheated steam or to run upon either high or low pressure steam, oil-free exhaust, and independence of the main units.

A still further development in the direction of compactness and simplicity is shown by Figs. 4 and 5, illustrating a 3,000 horse-power, two-stage centrifugal boiler feeder combined in one casing and on one shaft with a velocity-stage steam turbine. This unit, which also has been developed by the De Laval Steam Turbine Co., weighs, it is claimed, about one-tenth as much as a duplex reciprocating pump of the same delivery and occupies only about one-eighth as much floor space and one-fifteenth as much cubical space.

The pump end contains two single-suction impellers cast from a special bronze and carefully finished to exact contours. Two impellers are used for pressures up to 200 lbs. per sq. in., and three impellers for higher pressures. Single-stage boiler feed pumps have been built, but two or three stages are preferable because of the much longer life of the impellers at slower speeds. Each impeller discharges into a volute chamber by means of which the velocity in the water as it leaves the impeller is converted into pressure before the water is led to the eye of the succeeding impeller. This means of energy conversion is claimed to be superior to the use of diffusion rings as it is efficient over a wider range of delivery, and more important still, does not involve the use of small and sharp parts like diffusion blades, which are subject to rapid erosion.

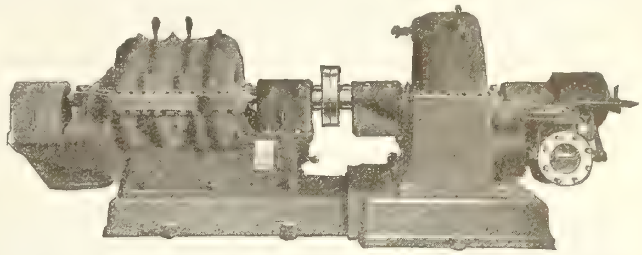


FIG. 1. DE LAVAL CENTRIFUGAL BOILER FEED PUMP COUPLED TO INDEPENDENT TURBINE.

The pump is hydraulically balanced and only one pair of labyrinth rings surrounding the suction opening is required for each impeller except the last, which has two sets of rings. The whole back of the impeller is subjected to a pressure equal to that existing at the periphery of the impeller, the same pressure acting on the front of the impeller, except for the area of the circle enclosed by the labyrinth ring about the suction opening. The last impeller, that is the one from which the water is finally discharged, is equipped with two sets of wearing rings, one on the suction side and one on the reverse side of the web. As some water from the discharge of this impeller will leak between the wearing rings into the space back of the web, this impeller would be equally as unbalanced as the other impellers in the pump if there were no escape for the leakage water. To provide for diminishing the pressure in this balancing space as much as may be required to

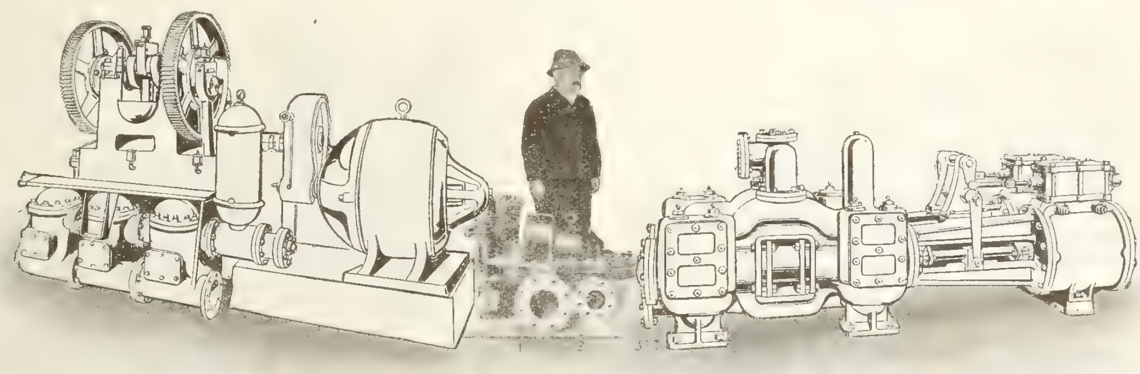


FIG. 2. COMPARATIVE CAPACITY DIAGRAM SHOWING STEAM TURBINE-DRIVEN BOILER FEED PUMP, DUPLEX STEAM PUMP, AND TRIPLEX MOTOR-DRIVEN PUMP.

bring the whole series of impellers into balance, a leakage outlet is provided from which water can be conducted back to the suction of the first impeller.

The outlet leakage takes place between two collars, one attached to the casing and the other carried on the shaft. When the shaft moves towards the discharge end of the pump this escape is closed off and the pressure builds up in the balancing chamber. If the shaft, on the other hand, moves toward the suction, this escape passage is opened wider, allowing the pressure in the balancing chamber to fall and at the same time the inleakage between the labyrinth wearing rings is decreased. By this means direct and positive balancing within very close limits is secured with leakage of but a small amount of water. The so-called natural balancing secured by the use of double suction impellers in a multi-stage pump is in comparison uncertain and imperfect, besides involving an extra long shaft, heavier impellers, and two pairs of wearing rings to each impeller.

The labyrinth wearing rings are readily renewable, the stationary ring of each pair being held in seat in the casing and the rotating ring being screwed upon the impeller. The reduction of leakage secured by the use of intermeshing labyrinth rings is highly important for securing high efficiency in pumps of comparatively small delivery. With the labyrinth type of ring the leakage path is so tortuous that very little water escapes even at high heads, although ample clearance is provided to take up expansion and contraction due to changes in temperature.

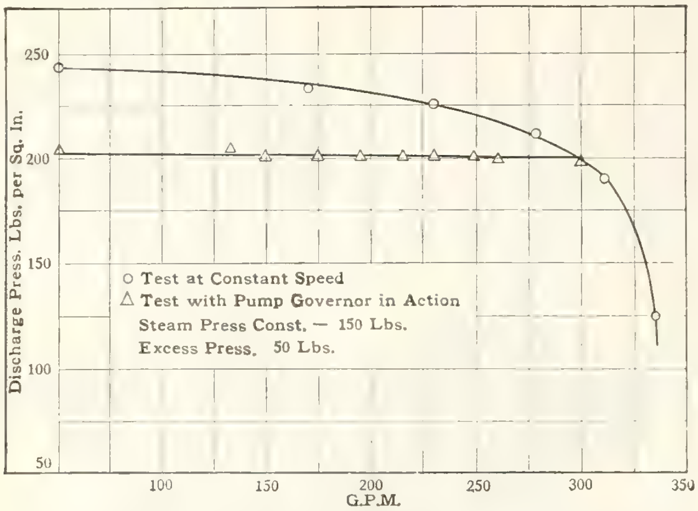


FIG. 3. HEAD DELIVERY CHARACTERISTIC OF DE LAVAL TURBINE-DRIVEN BOILER FEED PUMP UNDER CONTROL OF SPEED AND PRESSURE GOVERNORS RESPECTIVELY.

The suction end of the pump is adjacent to the turbine, and the shaft packing between the turbine and pump chambers is hence subjected to turbine exhaust pressure on one side and the suction pressure on the other. A simple packing is therefore sufficient, and in any case, any small leakage of steam in one direction or of water in the other does no harm. As the leakage space adjacent to the balancing chamber at the discharge end of the pump is connected back to the pump suction, the packing about the shaft is subjected only to suction pressure. Aside from the intermediate packing already mentioned, there is only one steam packing, which is subjected to exhaust pressure.

The steam end of the unit consists of a velocity- stage turbine with either two or three rows of moving buckets, according to the steam economy desired. The nozzles can be proportioned for either high pressure steam exhausting to feed heater or to condenser or for low pressure steam exhausting to condenser, or the unit can be made interchangeable, thus permitting of a great degree of flexibility in plant design. Where the exhaust steam from the boiler feeder is consumed in heating feed water, the thermal efficiency of the turbine- driven boiler feeds is greater than that of a boiler feeder driven by electric motor, or even than that of the main unit itself.

The unit is in some instances fitted with a speed governor mounted upon the end of the shaft, and when running at constant speed, the head varies with the delivery, as shown by the curved characteristic in the accompanying chart. As will be seen, the rise in pressure at reduced capacity is not excessive. Ordinarily, however, a pump governor controlled by the pressure at some point in the feed line near the boilers is employed to control the speed, giving a practically uniform pressure at all deliveries, as shown by the lower and straight line in the chart. In case of failure of the pressure governor to operate, the control of the unit is automatically taken over by the speed governor.

However, to provide against any possibility of racing, an emergency governor is also fitted. This consists of a pin contained within a hole bored diametrically through the shaft. This pin is held by a spring from flying out under the influence of centrifugal force. When the speed reaches a certain point, the spring is compressed so that the pin strikes a trip, releasing another spring by which the governor valve is closed at once and completely. Racing and excessive over-pressure are therefore impossible. The normal speeds of these pumps vary from 1,800 to 3,500 r.p.m., according to pressure and capacity, and due to the heavy shafts employed are far below the critical speeds.

The bearings are of the straight, split ring-oiled type, and like other parts subject to wear, such as the pump impellers, turbine rotor labyrinth rings, and governor valves, are built to a limit-gauge basis, so that they are all interchangeable. The entire rotating members and all wearing parts, with the exception of the governor valve, are accessible for inspection or removal upon lifting the casing cover and taking off the bearing caps,

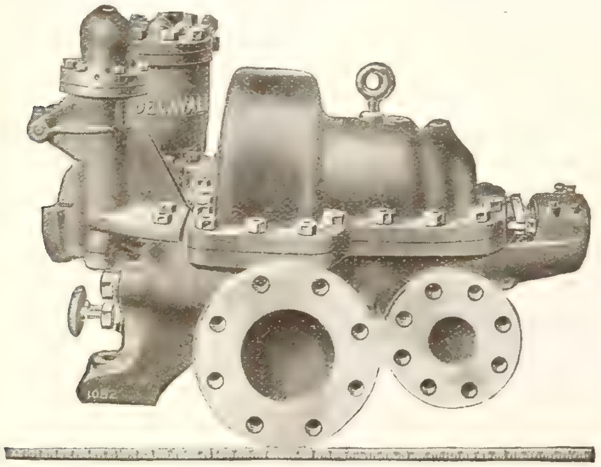


FIG. 4. DE LAVAL COMBINED TURBINE-DRIVEN BOILER FEED PUMP. CAPACITY 3,000 BOILER-HOUSE POWER.

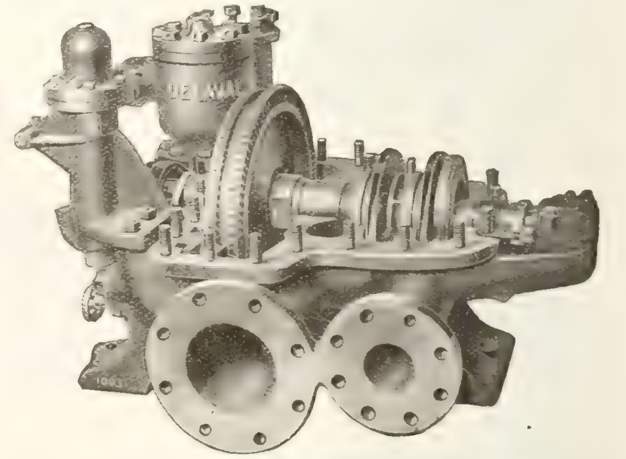


FIG. 5. DE LAVAL COMBINED TURBINE-DRIVEN BOILER FEED PUMP WITH CASING COVER REMOVED.

all of which can be done without breaking steam or water pipe connections.

In specifying the capacity of boiler feeders ,the temperature of the water to be pumped should always be stated, as the capacity is nearly 50 per cent. greater with water at 75 deg. F. than with water at 210 deg. F. For the same reason, capacity and efficiency tests of a pump should be carried out with water at the temperature at which it will be received by the pump when in actual service. The De Laval Steam Turbine Co inform us that they are equipped to make such tests on all pumps that it builds.

PLATE PUNCH TABLE

THAT the question of increased output from shipbuilding yards is receiving attention from makers of various items of equipment is evidenced by the engraving herewith, illustrating the Lysholm plate punch table which is being built by the Norbom Engineering Co., Philadelphia. It is designed for the purpose of facilitating the punching of steel plates, and is constructed in the form of a traverser of approximately twice the maximum length of plate to be handled. Four tracks are provided on which the table travels to and from the punching machine.

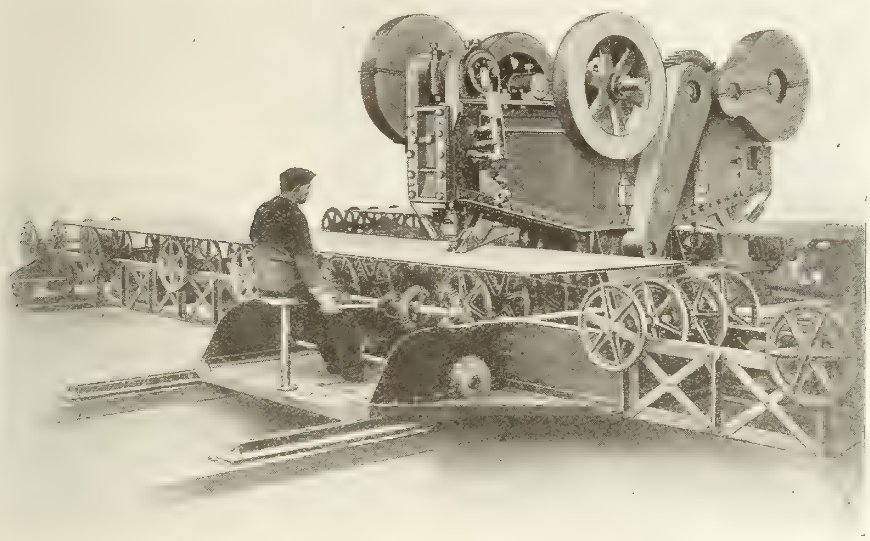


PLATE PUNCH TABLE.

The plate is supported by ten shafts fitted with discs on which the plate rests, the four shafts at the centre being geared together through the medium of chains and bevel gears, so that by raising the lever in his right hand the operator moves the ratchet plate to the left, and by depressing the lever, moves the plate to the right. A similar lever at his left hand coupled to a shaft lower down causes the traverser to move bodily to or from the punch. The punch itself is operated by a trip pedal at the operator's foot, or otherwise as desired.

Roller bearings and similar mechanical refinements are employed throughout to insure ease of operation to such a degree that one man can easily handle plates in half the time required with older methods. The size of plate which can be handled is from ¼ in. to 1 in. thick up to 25 ft. in length and 8 ft. wide.

LOAN TO ASSIST SHIPBUILDING

THE Imperial Munitions Board has accepted the offer of Sir Thomas White to make a special loan of ten million dollars to assist in the development of wooden ship building in Canada. Orders have now been placed for steel ships in Canada up to full limit of the shipyards available during the next fifteen months. In view of this, and the need for constructing every possible ship, the question of developing wooden ship building has been under investigation during the last month, and it has been represented to the Imperial Government that a substantial tonnage of suitable vessels could be obtained.

Specifications and designs of the type of wooden vessels required have been under discussion between the Imperial Munitions Board, the representative of the British Minister of Shipping and the various shipbuilding firms. These are now almost complete and will be available as a standard pattern of design. It is hoped to begin work on vessels of this type soon, and the building of a considerable number will be arranged for in Canada, probably for the most part on the Pacific coast, where suitable lumber is available, in abundance.

U. S. PLANS STANDARD SHIPS

REVOLUTIONARY changes in the method of building steel ships are likely to be one result of the campaign the United States is about to start with the object of putting ships afloat faster than the German submarines can sink them. The plan is to utilize in the construction of steel ships the American methods and engineering genius which has made the steel skyscraper the distinctive building of the United States. Place a skyscraper on its side and you have, as the engineers see it, what resembles fairly closely the steel frame of a ship except for the fashioning of the bow and stern. For many years the skyscraper has been built differently from the ship in that its parts have been fabricated at the steel plant and then shipped to the place of erection, where the only work to be done was to rivet them together.

This characteristic method of building a skyscraper if followed in the case of a ship, it is held, would reduce the time of construction. In other words, building ships by the skyscraper methods should enable the turning out of many more steel ships than would be possible under the plan now followed, not only because it would reduce the labor required at the shipyards, but also it would permit fabricating plants of the country to devote their energies to ship construction.

In its emergency programme for building ships to break the U-boat blockade, the Government under Gen. Goethal's supervision, is about to requisition the services of many of these steel fabricating plants that have been turning out American skyscrapers. When this plan was suggested to Gen. Goethals recently, it engaged his attention and now has practically been worked out. The big steel fabricating plants of the country have been consulted and are ready to perform their part of the plan.

The Government will have the authority to divert coastwise ships into the transatlantic trade. Ships on the ways, as well as those in commission, may be taken over by the Government to place in the service to the Allies, carrying food and munitions. Yards which have private contracts may be compelled to suspend them until the needs of the Government are satisfied.

Chairman Denman, of the Shipping Board, described as the purpose of the Board the formation of an enormous fleet of vessels under the American flag with the least possible delay. Wooden and steel ships now building will be taken over by the Government by arrangement with their owners. In four or five months the first of the wooden ships of the Board's emergency tonnage plan will be launched, but it will be six months, in the opinion of shipbuilding experts, before the delivery of these ships will become regular.

Ship Canal Approved.—Word is received that the International Joint Commission in session at Detroit had approved the proposed ship canal through the St. Clair River oposite Sarnia, Ont., all objections on the part of the Canadian officials having been satisfactorily met. The Canadian and American engineers were instructed to begin work on the project at once. and the estimated cost is $32,000. The channel will be dredged from the mouth of the Black River to the St. Clair tunnel and will be used by up-bound steamers.

Dominion Wreck Commission Investigations

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies.

S.S. "MASKINONGE" STRANDING

A FORMAL investigation was held in the Court House, St. John, N.B., on May 9, 1917, before Captain L. A. Demers, F.R.A.S., F.R.S.A., Dominion Wreck Commissioner, assisted by Lieutenant Commander A. J. Mulcahy and Captain James Hayes, acting as Nautical Assessors, into the causes which led to the grounding of the S.S. Maskinonge in the vicinity of the Sugar Refinery wharf, St. John harbour, on the morning of April 28, 1917.

Master's Evidence

The master, Benjamin Reese Griffiths, who holds a Board of Trade Certificate No. 018906, deposed that the Maskinonge was a single screw steel vessel of 2671 tons net and 4793 tons gross, and carried a crew of 42, including 3 duly certificated deck officers and 3 engineers; that she was capable of making a speed of 10 knots; was owned by Wm. Roberts & Company, and was under charter to the Dominion Coal Co., of Sydney, Cape Breton. He stated that he has been in command of this vessel for the past five years. The vessel with the pilot on board was navigated into the harbour, but as he was informed that the berth to which he was bound was occupied, it was decided to anchor, which was apparently effectively done. Five minutes later, the ship dragged her anchors, bringing them from the broad angle in which they had been placed to a more acute angle. The tide was running at the rate of 5 to 6 knots, and he did not dare to give more cable than had been given as there was a vessel anchored in close proximity to his stern.

Shortly afterwards the vessel took a sheer towards starboard and offered the port bow and side to the strength of the current. The starboard anchor was hove in short, then the port anchor. Meantime the vessel had grounded gently on the bank on the starboard side. Both anchors were hove in and found to be fouled. During this time the engines were kept working at various speeds; but to no purpose, and when it was recognized that the ship was fast, soundings were taken but did not disclose any leakage. As the tide was ebbing no efforts were made to free the vessel from her predicament.

On advice it was decided to make an attempt only when the freshet had subsided, which occurred the following Saturday, when the vessel came off without much effort and without apaprent injury. The method of anchoring was adopted with a view to preventing sheering, but the master has acknowledged that if the anchors had been placed at a more acute angle they would have been more effective.

Pilot's Evidence

Pilot Robert Doherty was the next witness. He stated that he had been piloting for nine years, having but one accident previous to this one; that he joined the Maskinonge on April 27, and on the early morning of the 28th, he decided to enter the harbour. There was a fresh northerly breeze and a freshet was raging causing the surface water to flow out at a speed of 6 knots. Upon receiving advice that the berth was occupied, and as he could not go back, nor anchor opposite the berth, he anchored off the Sugar Refinery Wharf, placing his anchor so that the ship would be as near midstream as possible. This was effective for the time being but, when on the point of going ashore, the vessel dragged her anchor and, after drifting a length of herself, the anchors held, and as everything seemed to be alright he went ashore, with the consent of the master. On reaching his house he heard whistle signals, and came back to the ship and helped the master with suggestions upon finding the ship stranded. He advised laying the port anchor off in midstream in order to prevent the ship's head from falling off further to the eastward, and the anchor was so laid.

At this stage of proceedings, in view of the straightforward evidence, and its nature, the Court did not think it necessary to examine other witnesses and adjourned sine die.

Finding

The evidence of the master and pilot, which was deemed sufficient for the purpose of the inquiry, shows that on the morning of April 28 last, on entering the harbour of St. John at 4 o'clock, they were advised that the berth at which the Maskinonge was to discharge, was occupied, and having to wait until the dock became vacant, it was necessary to anchor, which was done opposite the Sugar Refinery Wharf by letting go the port anchor, paying out 90 fathoms. The starboard anchor was let go when the ship had sheered sufficiently and tightened the port cable. On the starboard anchor 45 fathoms were run out, then 35 fathoms hove in on the port, tightening both cables; the anchors were at an angle of 12 points. This was done to prevent sheering, as the latter was expected owing to an unusual freshet existing, giving the tide, which was then at high mark and on the eve of ebbing, a velocity of 6 knots. There was another vessel at anchor astern which had to be considered. At the place of anchoring the width of the channel is two cables. Before the pilot left the ship, she dragged her anchors a distance of her own length, then appeared to stop, and seeing things apparently in a satisfactory condition, the pilot left.

The Court having carefully weighed this evidence finds that both master and pilot, under such abnormal conditions as existed at the time, did the best they could. A mistake or rather an error of judgment occurred as to the angle at which the anchors were disposed, by which their efficiency was reduced; but such error of judgment is of nonculpable nature, and therefore the Court will not hold either master or pilot at fault, nor censure them for such action. The Court has demonstrated that had the anchors been laid at a more acute angle the accident may not have occurred. Apart from the delay experienced the vessel was apparently uninjured. The Marine Superintendent of the Dominion Coal Co., eulogized the Harbour and Government Officials who rendered all the help possible in releasing the vessel from her dilemma.

TURBINE GEAR LUBRICATION

By O. C.

WITH the increased use of geared drives there is an increased necessity for minimizing friction, thus reducing the wear and noise and increasing efficiency. The best results so far have been obtained with helical gearing, and the use of this has proved extremely advantageous in the case of turbine drives for marine purposes and for direct current generators. The latest types of double helical gears are, however, those which secure the best results, great accuracy being combined with high efficiency and silent operation. The mounting of all gearing should have extra careful attention, especially as to the support of the pinion in high speed and high power work.

The lubrication of turbine gears is effected by means of special sprays arranged to deliver the oil direct on to the teeth, as to allow such gears to run partially submerged in an oil bath would absorb an appreciable amount of power. The pinions of turbine gears are usually of nickel steel, and the large wheels of cast iron with steel rims. To obtain quiet running, straight-cut rawhide, cambric and paper pinionss are sometimes used; ordinary hydro-carbon oil, however, is most destructive to rawhide pinions, and the fact that rawhide pinions have gained a bad name is entirely due to the use of this lubricant. One of the best compounds for rawhide pinions is as follows:—

Plumbago	15%
Resin oil	55%
Resin	30%

Cloth and paper pinions can be lubricated without injury with ordinary oil.

Accessory Equipment of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that determined effort is being put forth to initiate not only the design and construction of standard type ships for specific services, but that of their motive power—main andauxiliary reciprocating steam engine equipment, as well, with a view to acceleration of output and higher duty sea performance, this series of articles, describing and illustrating at least the more important instruments and accessory apparatus of the engine and boiler rooms seems to us more or less timely. The detail features of the various mechanisms will be discussed at length, also their specific application and utility scope.

STEAM ENGINE INDICATOR AND ITS DIAGRAMS

THERE is perhaps no device of such incalculable value, so simple in construction, and easy to apply, which is less understood and as little appreciated as the steam engine indicator. The latter has probably had more influence upon the development of the modern steam, gas and oil reciprocating engine, and gas compressing machines than any other factor, and has enabled designers to bring out the present-day improved types of valves and governors. It is an indispensable tool of the engine builder and erecting man for the final adjusting of valves and tuning up of the engine for the highest efficiency operation.

General Uses

Since adjustments of an engine in operation are not permanent, and conditions affecting the engine economy and output are subject to change, frequent readjustment is required. For this reason no modern operating engineer can afford to be without an indicator. The indicator shows whether or not the valves on the engine are set for the best possible steam economy, and it not infrequently happens that a few minutes' work in readjusting the valves will result in reducing the steam, gas or oil fuel consumption of an engine as the case may be, 25 to 50 per cent. for a given load. The indicator further shows the power developed in the cylinder, indicates piston and valve leakage, excessive cylinder condensation, excessive pressure drop from boiler to engine and proper distribution of load between cylinders of multiple cylinder engines.

Indicator First Cost

Considering steam in the ordinary industrial plant as worth anywhere from 20 to 50 cents per 1,000 lbs., it is readily seen that the cost of an indicator is insignificant as compared with the saving in money incident to rectifying and reducing the steam consumption of an engine a few pounds when figured out for an engine operating 10 to 20 hours a day throughout the entire year. The real dollar and cents value of owning an indicator is the means that it affords of immediately showing results in increased efficiency and economy, thereby making the engineer a more valuable and better paid man. Again, from the use of the indicator, he will learn more about steam engines in a short time than by many nights of study.

Steam Users' Attitude

Indicator diagrams receive comparatively little attention from steam users generally. In cases where indicating gear is provided, it is very frequently looked upon as a useless adornment of no practical use, and even where it is occasionally used, the cards obtained are looked upon merely as giving an indication of the power exerted in the engine. The quantity of coal burnt under the boiler in a given time is then ascertained, and a statement made that the engine is developing so many horse-power with a consumption of so many pounds of coal per hour; it is therefore developing power at the rate of so many pounds of coal per horse-power per hour. Although this is the ultimate test of the efficiency from a commercial point of view, the fallacy of the calculation, as above, is that it does not distinguish in any way between the efficiency of the engine and the efficiency of the boiler, so that a good engine worked in combination with a bad boiler, or a good boiler set badly, may give exactly the same result in pounds of coal per horse-power per hour, as a bad engine worked in combination with a thoroughly good boiler.

Engine Cylinder Work Record

Beyond enabling the observer to ascertain the power developed by the engine, however, the indicator diagrams when properly taken, studied, and understood, contain a great deal more information, and give practically a complete record on paper of what actually takes place in the engine cylinder when at work.

Thus wire-drawing of the steam due to the insufficient size of steam pipe, restricted passages in stop valve, throttle valve or ports, are at once made evident; incorrect setting or design of steam or cut-off valves, leaky pistons or valves, throttled exhaust pipes or passages, insufficient or excessive compression, are all shown; and by an analysis of the expansion curve—which, by the way, requires very considerable knowledge and care, both arithmetically and geometrically—wet steam, condensation, and sometimes re-evaporation, can be detected. All these mean losses in efficiency, each of them possibly small in themselves, but as engine economy is made up of a large number of small items, when they are added together the result becomes very appreciable.

Check on Valve Setting

The more nearly the steam admission curve up to the point of cut-off follows a horizontal line at or near the boiler pressure, and the more closely the expansion curve follows the theoretical curve—that is, one in accordance with the law of gases, as laid down by Marriotte, viz., that the volume varies inversely with the pressure—the greater will be the economy on the steam side of the piston. The exhaust side is also well worth study, as to make the engine work with the greatest smoothness and economy, the exhaust valve must, equally with the steam valve, open at exactly the right place, and the more quickly after the exhaust valve is open the pressure falls to the nearest possible point to that of the atmosphere, if working high pressure, or to the vacuum line if working condensing, and the more nearly by closing the exhaust at the proper instant the compression curve can be brought up at the end of the stroke to the initial pressure of the incoming steam for the next stroke, the more smoothly and economically will the engine work.

Economy thus obtained does not mean a saving in steam alone and keeping down the coal bill, but also means small costs for repairs, regular speed, absence of breakdowns, easy lubrication, and the least possible loss from depreciation, and consequently longer life of the engine and machinery. The indicator diagrams show at once if an engine is over or under loaded (both being highly uneconomical conditions of working), and a careful study will enable one to decide on what steps to take to improve the economy and reduce the steam and fuel consumption.

Engine Friction Demonstrated

Another very important feature of the indicator diagram from an economical point of view is that it enables us to ascertain what power is taken up in driving the engine itself, what is absorbed in driving various parts of the

gearing and machinery, and what remains available for doing work. These are very important points, as it frequently happens that 20 or 25 per cent. of the power developed in the engine cylinder is absorbed in driving the engine itself, another 30 or 40 per cent. being taken up in the gearing, shafting, etc. The indicator diagram is really the only means by which these many and various points can be graphically recorded, and in order that it may be of value it must be very carefully and accurately obtained and worked out.

Indicator Mechanism Delicate

The indicator is a very delicate instrument and requires handling with the greatest care, and it must be properly adapted for its purpose. For example, an instrument well adapted for taking diagrams of a low pressure slow-speed engine, is perfectly useless for a high pressure quick-speed engine, and very frequently considerable skill and ingenuity must be brought to bear in making the attachments. The length of the connections, the arrangement of the levers, the inertia of the instrument itself and other points all have a very important effect on the diagrams produced, while the reducing motion employed must be such that it will give to the card an exact reproduction, on a reduced scale, of the motion of the piston. All this, of course, means money; but it is usually money extremely well spent, as the cost of the investigation is generally saved many times over in the course of a year.

The shape of the figure traced upon the indicator card depends altogether upon the manner in which the steam pressure acts in the cylinder. If the steam be admitted at the beginning, and exhausted at the end of the stroke, and admission continue from one end to the other, the shape of the diagram is nearly rectangular. If the admission continue through only a part of the stroke, the diagram assumes a shape similar to that of Fig. 1. These two representative forms have, in matters of detail, numberless modifications.

Features of Indicator Diagram

Fig. 1 has been taken to illustrate the essential features of the indicator diagram, because it exhibits clearly all the operations affected by pressure that commonly take place in the steam engine cylinder. This diagram shows that the admission of steam commences at A and ends at D; the cut-off commences at C and becomes complete at D; expansion occurs from D to E; the release or exhaust begins at E and continues to the point H; the compression of the exhaust steam commences at G and ends at the admission point.

The line A B is called the admission line; B C, the steam line; D E, the expansion line; F G, the exhaust or back pressure line (or, in the case of condensing engines, the vacuum line); H A, the compression line; and J I, the atmospheric line. The curve which joins two adjacent lines, represents the action of the steam when one operation changes to another and cannot properly be classed with either line. The point of cut off, D, lies at the end of admission; the point of release, E, at the beginning of the exhaust, the point of compression, H, at the end of the exhaust. The proportion of the whole length of the diagram borne by the distance of the point D from the admission end, represents the proportion of the stroke completed at the point of cut off; so also in the case of the point of release, and in that of compression for the uncompleted portion of the stroke. The pressures at the points of cut-off, release and compression are the heights of

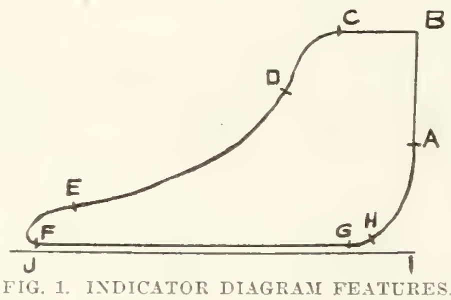


FIG. 1. INDICATOR DIAGRAM FEATURES.

these various points above the atmospheric line measured on the scale of the spring.

Indicator Applications and Purposes

There are three main objects for the determination of which the indicator diagram may be employed: 1, to serve as a guide in setting the valves of an engine; 2, to determine the indicated power developed by an engine; 3, to determine, in connection with a feed-water test showing the actual amount of steam consumed, the economy with which an engine works.

1—Fig. 1 shows the general features of a well formed indicator diagram, the attainment of which should be the aim in setting the valves of an engine. The admission of steam is prompt, making the admission line perpendicular to the atmospheric line; the initial pressure is fully maintained up to the point where the steam begins to be cut off; the somewhat early release secures a free exhaust and a uniformly low back pressure, and the exhaust valve closes before the return stroke is completed, providing for compression. These are the first requirements to be met in producing an economical engine.

Derangement of the valve gearing is revealed in the diagram by tardy admission or release, by low initial pressure or high back pressure, or by absence of compression, either one of which causes an increased consumption of steam for performing the same amount of work. The angular position of eccentric controls all the movements of the valves, but improper lengths of the rods which operate them, or improper proportions of lap and lead, are liable to produce some of the faults we mention, as will also a wrong position of the eccentric.

Exhaust Regulation

In regulating the exhaust of an engine, the desirability of employing compression should not be overlooked. In the first place, it serves to overcome the momentum of the reciprocating parts and to reduce the strain upon the connections caused by the sudden application of the pressure at admission. In the second place, compression is desirable on the ground of economy in the consumption of steam. It fills the wasteful clearance spaces of the cylinder with exhaust steam, otherwise requiring the expenditure of live steam from the boiler. Compression produces a loss by the increased back pressure which it occasions, but the loss is more than covered by the gain resulting from the reduction of clearance waste.

Hypothetically, the greater amount of exhaust that is utilized by compression, the less the consumption of steam. Practically, it is not advisable to compress above the boiler pressure. If a non-condensing automatic cut-off engine with 3 per cent. clearance working at 75 lbs. boiler pressure, cut off at one-fifth of the stroke, and exhausting under a minimum back pressure, the gain produced by compressing up to boiler pressure over working under the same conditions without compression, should be not less than six per cent. In a condensing engine, working under similar conditions, the gain should be larger. It should be larger, also, with an earlier cut-off.

Steam Pipes and Passages

The valves being in proper adjustment, the indicator diagram shows whether the pipes and passages for the admission and exhaust of the steam are of sufficient size. In automatic cut-off engines the steam line should be parallel with the atmospheric line, and the initial pressure should not be more than 3 lbs. less than the boiler pressure. The back pressure should not in any engine exceed 1 lb. when the exhaust proceeds directly to the atmosphere. Much can often be learned by applying the indicator to the steam and exhaust pipes, using the same mechanism for driving the paper drum as that used when the indicator is operated at the cylinder Before making adjustments upon engines that have been long in use, the operator should ascertain whether a valve which should travel to a different point has worn to a shoulder upon its seat. If changed under such circumstances, loss from leakage may follow, sufficient in amount to neutralize the

saving that might otherwise result. This is a matter of much importance.

Indicated Power Determination

2.—The indicator finds a second use in determining the amount of power developed by an engine. The diagram reveals the force of the steam at every point of the stroke. The power is computed from the average amount of this force, which is independent either of the adjustment of the valves, the form of the diagram, or of any condition upon which economy depends. The diagram gives what is termed the indicated power of an engine, which is the power exerted by the steam. The indicated power consists of the net power delivered and, in addition, that consumed in propelling the engine itself.

In this connection, the indicator proves invaluable for measuring the amount of power transmitted to a machine, or set of machines, which the engine is employed to drive. The process of measuring power thus used consists in indicating the engine, first with the machinery in operation, and then with the driving belt or shaft thrown off. The difference in the amount of power developed in the two cases is the desired result. Tenants and those who let power frequently employ the indicator for this purpose. The method of computing the power from the diagram is given later.

Steam Consumption Computation

3.—The indicator has a third use in connection with a feed-water test, in determining the number of pounds of steam consumed by an engine per indicated horse power per hour. This quantity forms a measure of the performance of an engine, and, when compared with the performance of the best of its class, shows the economy with which the engine works. The amount of steam consumed is usually found by weighing the feed-water before it is supplied to the boiler, the steam being employed during the test for no other purpose than driving the engine. This requires the erection of a weighing apparatus, the most satisfactory form of which consists of two tanks and platform scales. One tank is placed on the scales and these are elevated above the second tank, which is of comparatively large size. The water is primarily drawn into and weighed in the first tank. It is then emptied into the second tank, which serves as a reservoir, and from this it is pumped into the boiler.

A simpler plan may be resorted to, which gives approximate results. The feed-water is brought to a high point on the glass water gauge and then shut off, and a test made by observing the rate at which the water boils away. A fall of six inches may be allowed in nearly every case, without again feeding. The heights at the beginning and the end of the test being carefully observed, the amount of water evaporated and supplied to the engine is computed from the cubical contents that it occupied in the boilers. A test made in this manner can be repeated a number of times, and the results averaged to insure great accuracy. Feed-water tests, made by measuring the water fed to the boiler are of no value unless leakage of water from the boiler, if any exist, is allowed for. Attention should always be given to this point and the rate of leakage determined by observing the fall of water in the gauge, when no steam is being drawn from the boiler, a constant pressure being maintained.

Leakage, Etc., Losses

A portion of the feed-water consumption of an engine may be found without the aid of a feed-water test, by computation from the diagram. Were it not for the losses produced by leakage and cylinder condensation, to which engines are subject, the whole amount of feed-water consumed might be determined in this manner. Leakage of steam often occurs and cylinder condensation is inevitable, while the extent to which these losses act is not revealed by any marked effect produced upon the lines of the diagram. The measurement of the consumption of steam by diagram, therefore, cannot be taken to show actual performance, without allowing a margin for these losses. Much value, however, often attaches to these computations.

Besides showing the economy of an engine compared with the best of its class, the indicator, by means of the feed-water test, reveals the extent of the losses produced by leakage and cylinder condensation. These losses are represented by that part of the feed-water consumption which remains after deducting the steam computed from the diagram, or steam accounted for by the indicator, as it is termed. One of these losses, condensation, is nearly constant for different engines working under similar conditions, and an allowance may be made for this amount. The other, leakage, is variable in different cases, depending upon the condition of the wearing surfaces of the valves, piston and cylinder. The fact of the presence of the latter may be detected by a trial under boiler pressure with engine at rest, the leakage being revealed by escape at the indicator cock or exhaust pipe. The extent of its action may be found by computing that part of the loss not covered by condensation. In other words, in the case of leaking engines, when the indicator and feed-water test show that there is more loss than is produced in good practice by condensation, the excess represents the probable amount of loss by leakage. The indicator thus finds a valuable use in connection with the feed-water test.

OPEN CIRCUITS IN D. C. ARMATURES*

A VERY frequent form of breakdown to all direct-current armatures is that of an open circuit, which may be due to broken wires at a point close up to the commutator, and between that and the armature coils, or may be only due to a melted connection on the commutator lug. There are several causes for this defect, which may conveniently be classified as follows:—

(a)—Mechanical causes.

(b)—Electrical causes.

Considering first the mechanical side of the question, it will be found that in nearly all cases there is to some extent a slight movement between relative parts of the armature; that is to say, between the windings and commutator. Relative movement or vibration can be set up by a faulty drive or even by the rotation of the armature itself, if the machine is not securely fixed to or on a suitable foundation. Perhaps the most frequent cause of this class of breakdown is a loose key on either the commutator or the armature core, and in this connection the following example demonstrates a failure of this type.

The machine in question is of 60 horse power, and runs at a speed of 600 revolutions per minute on a 440-volt circuit. The laminated core of the armature windings is fitted direct on the shaft, and held in position by a key 13¼ ins. long by 1¼ ins. wide by ⅝ in. deep. The movement of the core on the key had apparently been taking place for some considerable time, and the wearing away of the key and also of the shaft was very considerable. Both the key and the shaft are now covered with circumferential grooves caused by the rubbing of the individual laminations of the armature core. The position of the ventilating ducts and also the alignment slot in the core remained normal. As a result of the breakdown, it was necessary to carry out the rebuilding and rewinding of the armature, including a new shaft.

Considering next the electrical causes of this type of breakdown, a machine that is run above its rated output is more liable to break down on account of the overheating of both the commutator and the conductors, which frequently reaches such a point that the solder in the commutator lugs is melted out. Also, as the commutator wears down, the current carrying capacity is thereby reduced, though at first not very appreciably. The time usually arrives, however, when the section of copper is so much reduced that overheating takes place, and the connections suffer. Machines have been known to break down repeatedly, due to melted connections caused by a commutator of restricted design, and after a new commutator of more ample proportions has been fitted, the same machine has run satisfactorily. Open circuits, broken wires, or bad joints very quickly show their presence, as the machine commences to spark violently

*Article in Vulcan by a member of the staff.

each time the two ends of the open circuit come under the brushes, and if this is allowed to continue, the commutator is very soon burnt, and, as often occurs, requires several new sections of both copper and mica fitting.

SHIP-TRIALS WITH RELATION TO SEA SPEEDS

WHILE it is generally admitted that the speed attained by a steamer on a trial trip has very little relevance to her performance on service, all owners have not abolished the successful trial trip as part-basis of their contract with the builders, says a writer in the Times' Engineering Supplement. Merchant ships in the majority of cases go on trial loaded in a manner which does not even approximate to their average condition on service, and the most useful function performed is that of testing the boilers and engines. The speed obtained by a vessel run on a measured mile gives the owner only an indication of what may be expected at sea, but the trial is helpful to the builder, as it provides useful data for the performance of other ships running under similar conditions.

Resistance at Sea

It is well known that the resistance of a ship in a sea-way is much greater than the resistance in smooth water for the same speed. Among waves the ship rolls and pitches, and pitching is very productive of increased resistance. The amount set up will largely depend upon the size of the vessel; waves which would cause violent motion in small steamers have little effect on large liners. On the whole, the waves set up irregularities in the resistance and in consequence the speed alters, a good deal of resistance being used up by the acceleration produced. The skin friction resistance is also increased, since greater bodies of water have to be set in motion. Nor is this all; the pitching may render it advisable not to run the propellers at full speed, on account of the danger from racing, and, in any case, the disturbance of the water decreases the propeller efficiency.

On trial, again, a vessel will be running with a clean bottom, an ideal condition which cannot be regularly maintained with a ship in commission, and a small amount of fouling is sufficient to cause an appreciable increase of the skin friction. In experiments with different kinds of surfaces, Mr. Froude found that rough surfaces had nearly twice as much resistance as smooth, hard surfaces. Should a vessel be allowed to get her bottom very foul, the increase in skin resistance may be even greater. As a rule—at least in vessels frequently in home ports—great care is taken to maintain the bottom clean, but even in the temperate zones a ship left for, say, six months, might easily have her skin friction increased by one-third. This would be a very serious matter in slow and moderate speed vessels, such as tramps, intermediate liners, and the majority of first-class passenger steamers, as the frictional resistance would never be much less than 70 per cent. of the total. If it should be the practice to measure the fouling of the bottom by noticeable loss of speed, it may be that considerable loss of power would be taking place before the discovery was made. In a moderate speed vessel the resistance due to skin friction might be doubled with the loss of only about two knots in speed. There is still another difference between trial runs and sea voyages; in the former the boilers are clean, and remain so throughout the short period of the trial, whereas, at sea, a certain definite loss must be put up with as the boiler tubes become dirty.

Pitching and Form

The fact that pitching causes so much loss in speed has resulted in the adoption of numerous expedients whereby it may be reduced. Practically all seamen favor full lines forward, and to a less degree aft, as being effective in this direction, whereas in a smooth water trial a full middle body with fine ends is advantageous for easy driving. All model tank experiments show great advantages for full 'midship sections and parallel middle body in practically all merchant vessels, and these advantages are found on the smooth-water trial trip. It is, however, generally admitted that speed in rough water will be more easily maintained with a fine 'midship section.

With the object of determining the effect upon resistance due to the pitching caused by the waves, R. E. Froude carried out some experiments on the resistance of models running in water which was artificially agitated to give a wave formation. The experiments represented the ship steaming against a regular head sea; the models were ballasted so that their trim was correct and the distribution of weight proportional to that of the ship. The results of the increase of resistance were plotted for a given speed to a base of wave period. The resistance had a very marked maximum. The period of the wave corresponding to the greatest resistance, exceeded that of the pitching period of the ship, and the largest waves more than doubled the resistance of the model over that for smooth water, while a difference in wave period of 15 per cent. either way from that of the ship caused the increase of resistance to be half as much again as that for smooth water. Among waves, differences in resistance due to small variation in forms were found in every case, but they were much less than the differences due to the variation of the longitudinal distribution of weight. Perhaps the most interesting result of the experiments, and, in fact, the reason for which they were undertaken, was the difference between hollow and straight water-lines forward. In smooth water, the resistance of the straight-lined model was greater than that of the model with hollow lines, but the increase of resistance in the waves above that for smooth water was greater in the hollow than in the straight-lined model.

Sea Speeds and Design

Whatever be the reasons for the increased resistance of ships in a sea-way, it is quite certain that sea speeds of vessels form valuable guides to future designs, and it is perhaps remarkable to find so little variation of speed from the average as is recorded in ships' logs. The advantage of technical advice to the shipowner in this respect is obvious, and some shipping companies do not trouble themselves about trial trips on the measured mile, being content merely to specify the attainment of a certain horsepower by the machinery. From the service results of their other ships they are then able to estimate what the sea performance of this new vessel is likely to be, and it is on this speed that schedules are drawn up, and not on trial speeds. The owners' technical advisers are not only able to arrive at the horse-power necessary for a certain sea speed, but in addition they know the average draught and displacement at which the ship will usually run when in service.

Vessels intended for service in shallow water generally require a different form of hull and a different type of propeller from those running in deep water. It will often be the case that the shallow water vessels have their trials run in deep water when a certain speed has to be obtained, and the form and propellers designed to obtain good results on the deep water trial will not necessarily be the best for the ship in service in shallow water.

SHIPBUILDING DIFFICULTIES

THE scarcity of steel is given as one reason why any important progress in the development of steel shipbuilding in Canada may have to be deferred. Steel capacity within Canada is largely taken up until the middle of 1918, with the bulk of contracts based on Government requirements in connection with munitions. These contracts may be further enlarged to absorb most of the output for 1919, so, unless any considerable part of the capacity of the mills should be released from munitions on the ground that shipbuilding might be more urgent, the outlook is not encouraging. Even in that event there would be delays until mills to roll ship plates could be equipped.

On the financial side, others see difficulties for an extensive shipbuilding programme in the new Canadian taxation. One large eastern concern is said to have laid aside its plans for a shipbuilding plant on the ground that new capital could not be enlisted in support of such an enterprise, when the risks of loss would have to be heavily scaled down to meet taxes. This, too, is said to be entering as an adverse factor in the plans of some American capital that was coming into the country for the purpose.

"Willie," said his mother, "I wish you would run across the street and see how old Mrs. Brown is this morning." A few minuts later Willie returned and reported: "Mrs. Brown says it's none of your business how old she is."

Launching Pressure Calculations and Vessel Motion*

By P. A. Hillhouse, B.Sc.,, and W. H. Riddlesworth, M.Sc.M., Eng.

The paper describes a method of calculating launching pressures and moments, which takes accurate account of tide, declivity and camber effects. In addition, a form of fore poppet, which has been developed and successfully used by the Fairfield Shipbuilding & Engineering Co., is featured, as are also some model experiments undertaken for the purpose of determining the actual motion of a vessel during the whole process of launching.

SEVERAL papers have already been submitted to this Institution on the subject of the launching of ships. The first was a general non-mathematical essay by the late John W. Shepherd. It was read in the year 1877, and contained a statement that the object of cambering the launching ways was to avoid the possibility of their becoming hollow should there be an accidental subsidence of the ground. The effect of camber upon pressures and moments were apparently not realized. Mr. Samuda's paper in the same year gave data in connection with the launching of large vessels, the "large vessel" of that date being a battleship of 285 ft. in length and 7,400 tons displacement. In 1882 Mr. Denny gave a very interesting paper on launching velocities, with data for many vesseis built by his firm. Mr. Luke in 1907 gave much useful information regarding the launching of the Cunard liner Lusitania, and drew attention to the advisability of estimating the pressure existing between the hull and the after end of the ways.

Of matter published elsewhere than in the Institution Transactions, we would like to draw attention to the very complete account of the launch of the Mauretania, which appeared in **The Shipbuilder, Vol. I., No. 4.** The velocity and acceleration of the vessel are traced from her first movement until she was finally brought to rest by the drags. H. R. Champness in 1899 described the launch of the battleship **Ocean** to the Institution of Mechanical Engineers. The Journal of the United States Naval Institute for December, 1912, contains an account of a rocking fore poppet in the launching arrangement for the American battleship New York.

Method of Calculation.

Approximate methods for calculating the hydrostatical elements of a ship during launch form the subject of portions of some of the papers already quoted. Having had occasion to investigate a launching problem admitting of many variations under circumstances which mde it imperative that the number of approximations used should be as small as possible, the following routine method was devised:—

1—A series of curves of displacement and longitudinal position of centre of buoyancy was drawn for ranges of draught and trim exceeding those likely to occur during the whole launching process. Twenty-five displacement and centre of buoyancy calculations, cross-faired in both directions, were sufficient to allow of those items being plotted on a base of draught at A.P. for each foot of trim through the required range (Fig. 1).

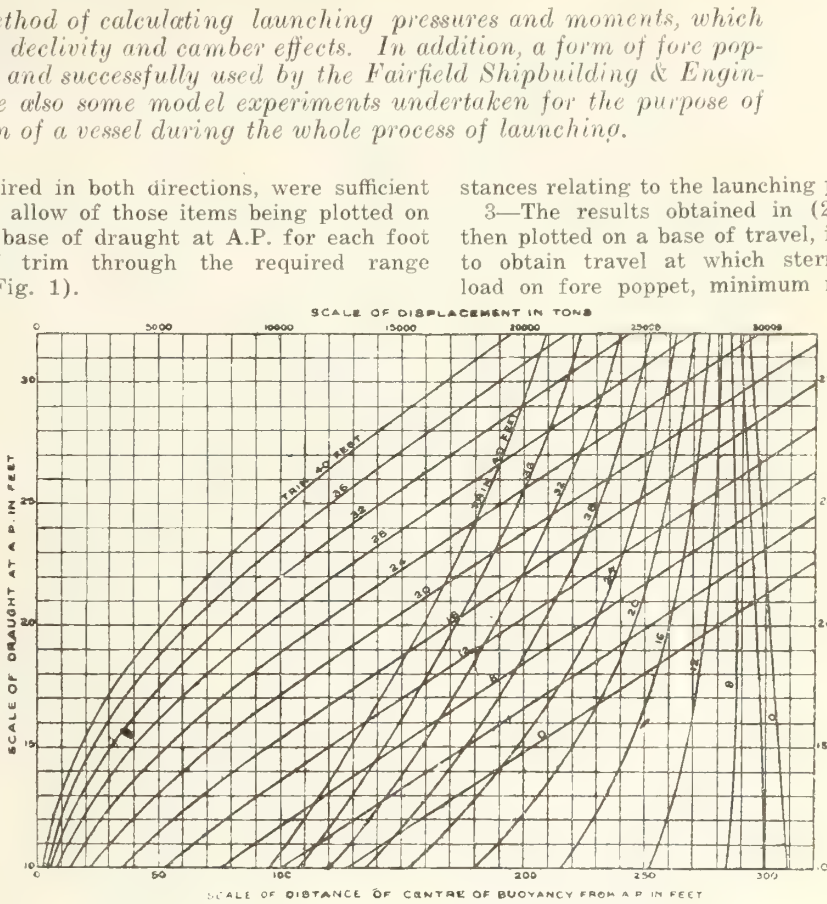
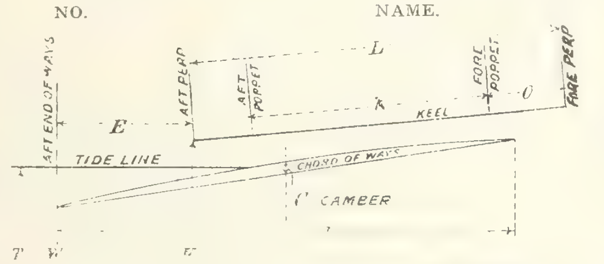


FIG. 1. LAUNCH CALCULATIONS.

NO. NAME. DATE.



k = declivity of keel
w = declivity of ways
Δ = Launch weight
g = A.P. to C.G. of ship
Draught forward
Draught aft
Moment of weight about fore poppet Δ (L − O − g)

	Travel.	o.	—	t.	—	—	—	—
1	A.P. from ½ L of ways	½ l − E − t_o		$x_o + t = x$				
2	Fall in above distance	$x_o w$		$x w$				
3	Round down in above distance	$4c\left(\frac{x}{l}\right)^2$		$4c\left(\frac{x}{l}\right)^2$				
4	Total fall in above distance	4_o		2 + 3				
5	Height of ways at A.P.	H − 4		H − 4				
6	Height of keel at A.P.	K		H − 4 + K − (H − 4_o) = K + 4_o − 4				
7	Draught at A.P.	T − K		T − 6				
8	Change of trim			$8\frac{cL}{l^2}t$				
9	Trim	L k		L k + 8				
10	Displacement			From displacement diagram for 7 and 9				
11	Load on ways			Δ − 10				
12	Centre of buoyancy from A.P.			From displacement diagram for 7 and 9				
13	Centre of buoyancy from A.E.W.			12 + E − t				
14	Buoyancy moment against tipping			10 × 13				
15	Weight moment causing tipping			Δ (t − E − g). Note sign + or −				
16	Total moment against tipping			14 − 15				
17	Centre of pressure from A.E.W.			16 ÷ 11.				
18	A.E.W to fore poppet			See text				
19	Pressure distribution			or See text				
20	Pressure per foot length, mean			See text				
21	,, ,, ,, maximum			,,				
22	,, ,, ,, minimum			,,				
23	Pressure per square foot at A.E.W.			,,				
24	Centre of buoyancy from fore poppet			L − 0 − 12				
25	Buoyancy moment about fore poppet			24 × 10				

2—For each change in one of the many variables a launching calculation sheet was then filled in, headed by a diagram setting forth the initial circumstances relating to the launching process.

3—The results obtained in (2) were then plotted on a base of travel, in order to obtain travel at which stern rises, load on fore poppet, minimum moment against tipping, and maximum pressure on after end of ways A.E.W. (Fig. 4).

4—Cross curves were then plotted

*Part I. of a paper read before the Institution of Naval Architects, March 29, 1917.

showing the effect of change in any one variable, e.g., Fig. 2 shows the effect of varying tide, whilst Fig. 2a shows the effect of varying camber for one particular set of circumstances.

The sheet is designed to facilitate the calculation in a systematic manner of the draught at A.P. and the trim, corresponding to any given travel, the recording of the displacement and position of centre of buoyancy under these circumstances, and finally the estimation of the required loads and moments. The diagram at the end of the sheet contains all the essential dimensions in the layout of the launching ways. The number of dimensions required for this purpose is very limited, being—

Two declivities (total rise ÷ total length), viz.:—

Keel	k
Chord of ground-ways	w
Three heights, viz.:—	
Keel at A.P.	K
Top of ground-ways at A.E.W. ..	W
Tide line	T
Five lengths, viz.:—	
Ship	L
Overhang forward of fore poppet.	O
Sliding ways between poppets...	Y
Standing-ways	l
Extension of standing-ways beyond A.P.	E
One camber, viz.:—	
On whole length of standing-way	c

Two points may now be emphasized—

(i)—The declivity of the ship and of the ways is so small (about 1 in 20, or say 3°) that changes in height may be estimated along a perpendicular to the chord of the ways and applied as if they were vertical, without appreciable error.

(ii)—Whilst recognizing that the sliding surface is necessarily circular, slope and round down may be estimated as if the curve were a parabola passing through the ends and mid-point of the standing-ways.

These approximations are, more or less, equivalent to assuming that cos 3°=1, when it actually is .9986. The possible accuracy of launch calculations in general is far below the grade of this approximation. The most convenient point on the standing-ways from which to reckon distances along and perpendicular to the ways is the highest point of the camber or mid-length of the ways. The height of this point is—

$$W + \frac{l}{2}w + c, \text{ say} = H$$

To determine the height of the sliding surface at any point, distant say x abaft the mid-point, we have—

Fall due to declivity$=xw$

Reduction in camber or round down$=$

$$c\left(\frac{x}{\frac{1}{2}l}\right)^2 = 4c\left(\frac{x}{l}\right)^2$$

$$\text{Total fall} = xw + 4c\left(\frac{x}{l}\right)^2$$

Height of sliding ways at the specified point—

$$H - xw - 4c\left(\frac{x}{l}\right)^2$$

The initial distance of A.P. from the mid-point of the ways$=\frac{1}{2}l-E$.

Line 1 can now be filled in, entering $\frac{1}{2}l-E$ under zero travel and $\frac{1}{2}l-E+t$ under travel t, etc.; and lines 2, 3, and 4 in virtue of the above relations.

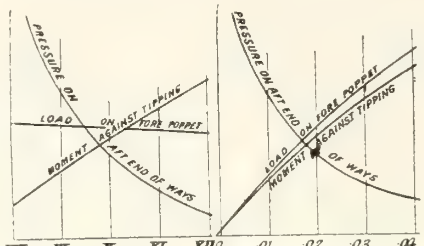


FIG. 2. FIG. 2a.

Line 5 gives height of ways at the successive positions of A. P.

The initial height of keel K is entered under zero travel in line 6, and as the distance between keel at A.P. and the sliding surface is constant so long as the ways are in contact over the whole overlapping length, line 6 can be completed by adding to line 5 this constant difference.

Line 7 draft at A.P. is merely (height of tide—height of keel at A.P.).

Having obtained draft at A.P. we now turn to trim. The initial trim is Lk, which can be entered under column zero travel in line 9. The change of angle for any travel.

$t = 8c\frac{t}{l^2}$, and the corresponding change

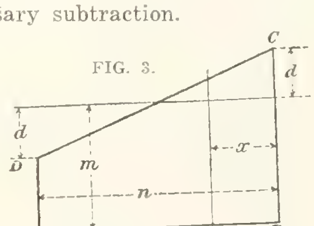
of trim $= 8c\frac{t}{l^2}L$.

This enables us to fill in lines 8 and 9.

The displacement diagram is now referred to, and the displacement and position of centre of buoyancy read off; these are now entered in lines 10 and 12. Line 11 is obtained by the subtraction of the displacements in line 10 from the weight of the ship at launch.

A.P., being initially E before A.E.W., at travel t is t—E beyond, and as line 12 gives position of C.B. before A.P., line 13 can be filled in by making the necessary subtraction.

FIG. 3.



Line 14: Moment of buoyancy against tipping is the clockwise moment of buoyancy about A.E.W., and is the product of lines 10 and 13.

Line 15: Moment of weight causing tipping is similarly the anti-clockwise moment of the weight about A. E. W.; if g is the distance of C.G. of ship forward of A.P., the initial position of C.G. is E+g before A.E.W. (C.G. of course passes A.E.W. when travel=E—g.) Distance of C.G. from A.E.W. at travel t is t—E—g ,and moment of weight causing tipping is weight× (t—E—g); which will be negative until C.G. passes aft end of ways, and positive afterwards.

The total moment against tipping (line 16) is obtained by subtracting the figures in line 15 from those in line 14.

The moment against tipping being balanced by the reaction of the standing-ways, and the total pressure or load on the standing-ways being given by line 11, we find the distance of the centre of pressure of load on ways from A.E.W. by dividing the figures of line 16 by the corresponding ones of line 11.

Line 18: Amount of overlap of sliding and standing-ways is obtained as follows:—

Initial distance A.E.W. to fore poppet=E+L—O.

Distance at travel t=E+L—O—t.

If not greater than length of sliding-ways this is the amount of overlap, otherwise amount of overlap is Y.

We have now to consider the pressure betwen standing and sliding-ways as regards distribution. Line 11 contains full details of the amount of this pressure, on the assumption that the slip moves as if completely constrained by the ways, which is true up to the travel at which the stern rises, of which more anon.

We know then the amount of load, the position of its centre of gravity, and the length and position of the over-lapping portions of the ways carrying the load. In order to find the intensity of the pressure at any point, we must make some assumption about the distribution. The assumption which lends itself most readily to calculation is that of a linear variation, and this will be adopted in what follows; although there is no intrinsic reason why it should be the one most nearly representing the truth, there are indeed some very good reasons for doubting the truth of this assumption.

Let the area ABCD represent the amount of a load distributed over a length A B in accordance with the straight line C D; call this trapezoidal distribution. Let the centre of pressure on the surface represented by A B be at a distance x from B, then—

m the mean pressure=P/n,

Where P=total pressure or load.

n=length of surface carrying the load.

Now let d be the amount by which the maximum and minimum intensities exceed or fall short of the mean.

Taking moments about the mid-point of AB we have

$$\frac{1}{2}\frac{n}{2}d \times n = mn\left(\frac{n}{2} - x\right)$$

whence

$$d = 3m\frac{n-2x}{n}$$

It may be pointed out that with the type of pressure distribution here assumed it not seldom happens that the

mean pressure on the ways is considerably departed from at the ends of the sliding-ways even before the ship begins to move; and it is certainly true that when the last operation prior to the actual launch is the cutting away or removal of keel blocks forward or aft, the pressures at the ends greatly exceed those calculated by such means as those indicated above, whilst of course at some other portion of the ways the pressure is correspondingly reduced.

The figures of lines 17 and 18 require a little examination before proceeding further. If the centre of pressure falls exactly half-way along the overlap, the pressure intensity is uniform, if it falls exactly one-third the length along the overlap the pressure varies from zero at one end to twice the mean at the other, if within the middle third the pressure distribution is such as A B C D.

If the centre of pressure falls outside the middle third the reasonable assumption is that the curve of distribution is a straight line forming a triangle with the axis and the vertical at one end of the length in contact. This

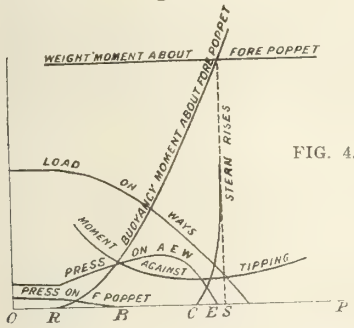


FIG. 4.

avoids the supposition that tension exists between the sliding surfaces. A graphic method of determining these points is mentioned later and may be used with advantage. Line 19 can now be filled in with a series of small diagrams of the pressure distribution as—

indicating pressure part way along overlap and greatest at A.E.W.

indicating pressure along all overlap and greatest at A.E.W.

indicating pressure uniform.

indicating pressure all along overlap and greatest at fore poppet.

indicating pressure part way along overlap and greatest at fore poppet.

The formula just established for the departure from the mean pressure in trapezoidal distribution is now applied to the appropriate cases and the maximum and minimum pressures thus determined. When the pressure distribution is of what might be called the triangular type the procedure is to find the distance of the centre of pressure from the heavily loaded end; multiply this by 3, and so obtain the length over which the pressure is distributed, the mean and maximum pressure are then obvious.

This completes lines 19, 20, 21 and 22. Line 23 is merely the maximum pressure per foot length of ways at A.E.W. divided by the combined width of the ways.

Line 12 gives distances of centre of buoyancy from A.P., subtraction of this distance from (length of ship—overhang forward) will give distance of centre of buoyancy from fore poppet, line 24; the product of displacement from line 10 and the distance tabulated in line 24 gives moment of buoyancy about fore poppet line 25.

It need scarcely be said that constant plotting should be adopted to check and confirm the figures entered up line by line; many errors may in this way be detected at a stage when they can easily be remedied.

The essential curves in the final launch diagram are obtained (1) from line 25, moment of buoyancy about fore poppet, the intersection of which with a straight line representing the moment of the weight of the ship about fore poppet gives the point in the travel down the ways at which the stern begins to rise—beyond this point the curves under consideration have no value; (2) from line 11, which gives the load on the ways and consequently at the travel indicated above the load on the fore poppets; (3) from line 16, which gives the moment against tipping, the graph of which enables us to determine the minimum value and position at which it occurs; (4) from line 23, giving the pressures on A.E.W.; also from lines 21 and 22 a curve of maximum pressure on the hull of the vessel can be attained by plotting the actual distribution of the pressure, completely defined in lines 19, 21, and 22, on the hull and drawing the envelope of the series of trapezoids and triangles thus obtained. The pressure intensity becomes infinite (in theory) when the stern begins to rise.

Interesting information about change-over points in the pressure distribution curves can be obtained by plotting lines 17 and 18, and adding straight lines defining the position of the middle point and the middle third of the overlapping part of the ways. Indeed, the travel when the stern rises can be determined by these means, as the travel when the centre of pressure on the ways coincides with the fore poppet.

In Fig. 5 travel is measured along OP, and at any travel, say OT—

TK′=amount of overlap of ways.

TL′ andTN′ define the position of the middle third of the overlap.

TM′ gives the position of the centre of the overlap.

TA′=distance of centre of presure from A.E.W.

The pressure distribution is as indicated by the small diagrams in the spaces bounded by the straight lines specified above.

At S the stern rises, and if it should happen that the line A B C D E S touches the axis O P the minimum moment against tipping is zero. Whilst if it crosses, there is an actual tipping moment.

If the special displacement-centre of buoyancy diagram already mentioned has a range which includes the actual launched draught, it can be used to find the water-line at which the ship would float if at rest with the fore poppet on the ways after the stern has risen. Two additional sets of curves are required, viz.: (1) A set of curves giving the draught at the fore poppet in terms of the draught aft and the trim; (2) a set of curves giving the moment of buoyancy about fore poppet for a sufficient range of trim and of draught. Knowing the draught at fore poppet, which can easily be calculated for any travel on the lines already laid down, and the moment of weight about fore poppet, we can from these two sets of curves pick out the trim which gives the requisite moment, and hence the displacement and load on fore poppet which is the difference between this and the weight of ship.

Sometimes an important matter is that of the minimum clearance between the sliding surface and the hull of the ship; the method following is one by which the minimum distance between the lines of keel and of sliding surface and the position of this point of closest approach can be obtained.

The clearance is the distance between the keel and a line parallel thereto touch-

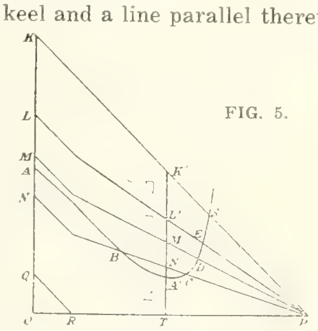


FIG. 5.

ing the sliding surface. The angle between this line and the chord of the ways, or tangent at middle point of length=w–k, and the distance along the ways from middle point corresponding to this change of angle is obtained from—

$$w—k = 8\,c\,\frac{x}{l^2}$$

$$\text{i.e. } x = \frac{(w—k)l^2}{8\,c}$$

and the round down or reduction of chamber is—

$$= 4\,c\,\frac{(x)^2}{l} = 4\,c\,\frac{(w—k)^2 l^4}{64\,c^2 l^2} = \frac{(w—k)^2 l^2}{16\,c}$$

The projection lines on the diagram annexed indicate the connection of the various dimensions, and the final expression for clearance becomes:—

$$\text{Clearance} = K—W—E\,k—c\,\frac{w—k}{2}\,l—\left(\frac{w—k}{4\,c}\right)^2 l^2$$

The additional clearance due to the rise of floor or shape of hull can be readily determined from a vertical section of the ship in line with the inner edge of the ways.

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PRINCIPAL CONTENTS

BEST SHIP SIZE TO MEET THE EMERGENCY

WHILE possibly of less moment so far as Canada's shipbuilding programme is concerned, due to the necessarily inland location of what constitutes the majority of her steel shipbuilding plants, it is worthy of note that expert opinion is not at all unanimous as to the size of merchant vessel to be constructed that will most effectually offset enemy submarine activities.

Last month our leading illustrated descriptive article—"Intensifying Our Shipbuilding and Marine Engineering Industries,"—urged more attention being given to the establishment of new shipyards from Montreal eastwards, and indicated Sydney and Halifax, Nova Scotia, and St. John, New Brunswick, as desirable locations. The opinion then expressed was that we have as many shipbuilding and ship-repairing plants on our lake shores as there is business for in normal times, although in this crucial period it can truthfully be said that their effort is no mean one. Ocean-going freighters, small, medium and large, cannot come amiss at this juncture, and cannot be pressed into service one moment too soon. However, there seems to be a disposition to lay overmuch stress on the value of small or medium size craft, and to encourage the building of the latter in plants whose equipment and other constructional facilities are capable of turning out vessels of three or four times the tonnage of the others. To this phase of the present shipbuilding propaganda considerable opposition has been aroused, and as already stated the attitude adopted has much to commend it, if not to wholly justify it.

A committee of shipping experts in Manchester, England, in a report recently made public, have the following to say on the preference being given small ship construction as against that of large ones where the facilities and equipment are available:—

"The policy of small ship construction can only have a most disastrous effect on the nation, the man-power required by the army, and our chances of victory. The Germans claim to be sinking 9,000,000 tons a year and hope to sink still more. Allowing losses by mines and natural causes to balance any exaggeration of the German claims, and assuming that we build one-half the lost tonnage (about two and a half times our pre-war output), and other countries the balance (over five times their pre-war output), we have increased last year's output by about four million tons, equivalent to 1,600,000 tons of cargo capacity per year.

"Comparing ships of 2,000 tons and 16,000 tons displacement, carrying 650 and 8,675 tons of cargo respectively, and taking the North Atlantic passage as a basis, we should require to build each year 2,460 of the smaller ships, but only 185 of the larger. The smaller ships would cost $555,000,000, and the larger only $230,000,000. The small ships would use 1,550,000 tons of steel and 575,000 tons of timber, and would consume 6,750,000 tons of coal on the outward voyages per year. The larger ships would absorb 1,030,000 tons of steel and 382,000 tons of timber, and consume only 1,560,000 tons of coal.

"The number of men employed in building the ships, including making and handling steel and other materials, would be 635,000 for the smaller ships and 285,000 for the larger. The coal consumed would account for 45,000 men for the small ships as against 10,500 for the large. Thus the larger ships would release about 380,000 persons for other national service. Moreover, the larger ships would require 60,000 fewer mariners. Again, the percentage of loss, both in number of ships and in cargo-carrying capacity, will be greater with small ships than large, and the former will produce greater congestion in ports.

"The policy of the small ships, therefore, is all wrong. All our shipbuilding energies should be directed towards building the largest ships our various yards can efficiently handle."

Marine News From Every Source

Montreal, Que.—The Dominion Bridge Co., Lachine, have equipped a part of their plant for building marine engines.

Kingston, Ont.—The Kingston Shipbuilding Co. has practically purchased the plant of the Kingston Foundry Co., adjoining its premises.

Sault Ste. Marie, Ont.—The weather continues unfavorable and heavy ice is interfering with navigation. A large number of freighters have been held up.

The Bawden Machine Co., Toronto, has been awarded a contract by the Thor Iron Works, Toronto, for 24 cargo winches, 4 windlasses and 4 steering engines.

South Vancouver, B.C.—The Board of Trade have started a movement to establish a shipbuilding plant here on the Fraser River, at the foot of Quebec Street.

Esquimalt, B.C.—A workshop will be built here by the Department of Naval Service, Ottawa, from which full particulars of the proposed plant may be obtained.

Mackinnon, Holmes & Co., Sherbrooke, Que., have recently received an order for a quantity of steel bow plates to be used in connection with troop scows being built in Canada.

Port Colborne, Ont.—Dewitt Carter, president of the Welland Canal Tug Co., has completed the sale of the two tugs, Alert and Escort, to the Montreal Transportation Co. The tugs will continue towing in the Welland canal.

Victoria, B.C.—Work is progressing rapidly on the G.T.P. steamer Prince Rupert at Esquimalt, where the vessel is drydocked. Messrs. Yarrows, Ltd., have a large gang of men at work and the steamship will be made ready for service again as quickly as possible.

Vancouver, B.C.—A contract for the first ship to be built on the North Arm of the Fraser River has been signed between Harrison & Lamond, contractors, and the Dominion Government. It calls for a wooden ship 225 feet long and 44 feet beam. The cost will be $225,000.

St. John, N.B.—Thomas V. S. Dickson, of Glasgow, Scotland, representing a Clyde shipbuilding firm, and A. D. Swan, of Montreal, have been in St. John and Halifax recently, looking over the ground to ascertain the possibilities of establishing a shipbuilding plant.

Vancouver, B.C.—For the purpose of having her coal-burning system changed to handle fuel oil, the steamer Quadra, formerly a Government lighthouse tender, but now owned by a Howe Sound mining concern, is at Vancouver. The alterations will be made by the North Shore Iron Works.

Extend Time for Loading.—The Standard Shipping Co. of Cleveland, Ohio, has arranged with Canadian shippers to extend the opening shipping period 5 days and boats loading to Fort William and Port Arthur will have fifteen days instead of ten days to report for cargoes.

Toronto, Ont.—The shipbuilding plant which is contemplated for the Ashbridge's Bay district will be backed by the Imperial Munitions Board. The plans are already well developed, so much so that prices are being obtained on the chief equipment required for the various departments of the enterprise.

Welland, Ont.—The Welland Shipbuilding Co., which was recently incorporated with a capital of $200,000, has taken over M. Beatty & Sons' shipyard and machine shop for a term of years, for the construction of steel freighters. A permit has been secured for building an additional slip on the Welland Canal.

Pilot Charges Raised.—An Order-in-Council has been passed increasing pilotage rates. The charge for pilotage for any sea-going vessel has been increased from $3 to $3.25 for each foot of draught, and for coasting vessels, from $2.50 to $2.75, but the charge for inland vessels remains at $2.50.

Sault Ste. Marie, Ont.—Ice conditions at Whitefish Point this year have delayed navigation at least ten days past the time that the freighters are usually able to proceed on their course up the lakes, which will mean a big loss to the shipping interest. A large number of vessels have been held up at the Soo.

Welland Shipbuilding Co., has been incorporated at Ottawa to carry on the business of constructing ships and other general construction business at St. Catherines, Ont. The incorporators are Francis H. Keefer, Harold A. Keefer and Donald Munro all of Thorold, Ont.

Tug Osborn Sold.—A report has reached Sarnia that the tug Chase S. Osborn, which was used for the past few seasons in towing boats to there from Lake Erie ports, has been sold to San Francisco parties, and will be used on the Pacific Coast. The purchase price is said to have been $90,000.

International Equipment Co. has been incorporated at Ottawa, with a capital of $250,000, to manufacture and deal in all kinds of railway, marine and foundry supplies at Montreal. The incorporators are: Arnold Wainwright, Aubrey H. Elder, and D. Burley-Smith, all of Montreal.

Boat Releasing Gear of Canada, Ltd., has been incorporated at Ottawa, with a capital of $226,000, to manufacture boat releasing gear and other appliances. Head office is at Montreal, and the incorporators are: Arthur R. Holden, Pierre A. Badeaux, and Arthur Charters, all of Montreal.

St. Catharines, Ont.—The possibility of the Dominion Government taking over sections one, two and three of the Welland Ship Canal, upon which work has ceased until after the war, is now quite apparent. An agent of the Government was lately in the city taking inventory of the various plants, and it is understood that his mission is based upon the above-named possibility.

Sarnia, Ont.—To facilitate the loading and unloading of steamers at the Point Edward freight sheds, six electrical trucks have been purchased and installed, each truck costing in the neighborhood of $3,600. The addition of this modern equipment to the other facilities in use at the sheds, completes one of the most modern freight handling depots on the Great Lakes.

Haileybury, Ont.—The boats of the Temiskaming Navigation Co., which ply between points on Lake Temiskaming, with headquarters at Haileybury, have been sold to Mr. Seymour, the member for Pontiac County, representing Ville Marie interests. The line will be operated this coming season under the name of the Ville Marie Navigation Co. Mr. W. Chenier, of Ville Marie, is the new manager.

To Raise the Keystorm.—The financing of a plan to raise the steel steamer Keystorm, of the Keystone Transportation Co., Toronto, which was lost at Chippewa Bay, twelve miles west of Brockville, Ont., in 1913, while carrying a cargo of 2,800 tons of soft soal to Montreal, has been completed. The steamer was built in England at a cost somewhere in the neighborhood of $150,000. If it could be floated now it would probably be worth $300,000. The Richardson Grain Company, of Kingston, has given the American branch of the London Lloyds $7,500 for the boat in its present position, it is stated. It lies with its stern in 110 feet of water and the bow is under about 35 feet. Pontoons are being built. Leslie, of Kingston, the well known riverman, is to have charge of the attempt to lift the boat to the surface.

St. Catharines, Ont.—The steamer Natironco, owned by A. B. McKay, of Hamilton, on May 3, carried away two head gates of Lock 3, Welland Canal. The freighter was upward bound when something went wrong with the engine. The damage is estimated at between $2,000 and $3,000. Repairs were completed on the head gates on May 4, and traffic resumed.

Steamer "G. A. Richardson" Sold.—Marvin M. Marcus, vice-president of the Great Lakes Transit Corporation, in charge of finance, announces that he has sold the steamer Granville A. Richardson to the Lake Transportation Co. of Mentor, Ohio, with offices in Cleveland. James Playfair, of Midland, Ont., is president and general manager of the company. The Richardson has been at Buffalo fitting out ready for service.

Sarnia, Ont.—The Reid Wrecking Co., has sold its Canadian interests to the Canada Steamship Line. It is understood that the deal includes the tugs James Reid, Sarnia City and Smith, all powerful towing craft, besides the Sarnia docks and machine shops of the line. The Reids still have the Fischer and Manistique tugs and the dry-dock at Port Huron. The company has also sold the steamer Kongo to Muskeegon parties, and her name will be changed to the Overland.

Victoria, B.C.—The speedy C. P. R. steamer Patricia, which regularly maintains the service between Nanaimo and Vancouver, was again on the ways at the Victoria Machinery Depot for the third time within about as many months, the cause of her being laid up on the present and the last previous occasion being the same in both cases, namely, that the vessel struck some submerged object resulting in injury to one of her propeller shafts.

Government Buys Coal Steamers.—The Dominion Government through the Department of Railways and Canals has concluded the purchase of two steamers, the Drummond and the McKee, to be used in the coal-carrying trade between Sydney and Montreal. The ships, which are of substantial carrying capacity , were secured from the Algoma Companies. Particular efforts are being put forth both to increase the coal production in Nova Scotia and to improve the carrying facilities.

Vancouver, B.C.—Construction operations on Walls & Co.'s marine ways on Hastings Townsite have been commenced The new slip will be 75 feet by 30 feet, and will accommodate an 80-foot vessel with a 10-foot draught. The plant will be fitted to receive repair work in about a month. The president of the company, P. Walls, has had twenty-eight years' experience in shipbuilding in the Old Country, the United States and Canada. He has been a resident of Vancouver for six years, and is well known here.

Canada Steamship Earnings Unaffected.—The new British order requisitioning all vessels under the British flag is not expected to have any material effect on the earnings of the Canada Steamship Lines, as it is pointed out fully nine-tenths of the company's fleet are under charter to the French Government and are not available until next February at the earliest. A director points out that such being the case the new order will make little change in the revenue of the company.

Ships of Ferro Concrete.—Advices from Norway say that an experiment is about to be made with two motor ships, the hulls of which are constructed of ferro-concrete, to test the fitness of such vessels for North Sea trade. The boats will be of 1,000 tons and 600 tons, respectively. Ferro-concrete lighters have been used successfully for some time in Swedish coast traffic. The Norwegian boats can be built in four or five months and are cheaper than those of steel or wood.

Vancouver, B.C. The steel steamer War Dog, the first ship of its type to be built in British Columbia, was launched at the Wallace Shipyard on May 17. The War Dog, with a length of 315 feet, 45 feet beam, and a depth of 27 feet, is the first steel cargo vessel to be built in this province, and the contract was placed by a Japanese steamship company through an English firm. Since the steamer has taken to the water she has been sold to a British firm of Liverpool, believed to be the Cunard.

Victoria, B.C.—The Drummond Lighterage Co., of Seattle, which recently sold the big car barge to the C.P.R. Co., has awarded contracts for two 800-ton scows to William F. Sehrs, shipbuilders, of Port Hadlock. The vessels are to be 120 feet long with a beam of forty feet and a depth of ten feet. With their completion, the Drummond company will have a total of eighteen scows in operation in the Puget Sound-British Columbia freighting business, the eighteen having a combined tonnage of nearly 10,000 tons.

Can't Build Wooden Ships.—It is reported that the plans of the U. S. Shipping Board to build large numbers of small wooden ships, to be turned out rapidly, will have to be abandoned. Shipbuilders say that there is not a sufficient supply of seasoned timber for the work, and it would be risky to experiment with green timber. It is also pointed out that, even if built, wooden ships would necessarily be slow and thus become an easy target for submarines, while because they are low above the water line, it would be difficult to use guns for self-defence.

Britain Orders 30 New Steel Ships in Canada.—Sir Thomas White announced in the House on April 23, that orders had already been placed by the Imperial Government for 22 steel vessels in Canadian shipyards. A further order for eight steel vessels would be placed and these ships would total 175,000 tonnage. All the plants in Canada had orders sufficient to carry them into the middle of 1918. He had taken up with the Imperial Munitions Board the question of building wooden vessels in Canada. He was prepared to furnish a ten-million-dollar credit for the building of wooden vessels.

Ferry "St. Louis" Sunk.—The St. Louis, owned and commanded by Captain P. McLean, sank on the morning of April 20, at its moorings in the Elgin Basin, Montreal. The vessel had seemed all right when the captain left it on the previous night, but at 7 o'clock the following morning only the bow was above the water, being held in that position by the mooring ropes. The St. Louis has been in the Verdun and La Tortue ferry service for the last ten years. Ice is stated to have caused the sinking. The vessel, which is of 269 tons, has been raised.

Work on Welland Canal Ceases.—Work on the Welland Ship Canal was completely closed down on May 2, when the services of all the engineers' staff were dispensed with, including those of J. L. Weller, engineer in charge to whose initiative the building of this great work is due. The contracts for four sections, comprising about eleven miles of canal, and all the seven lift locks and amounting to about $25,000,000, are about half completed. The contractors were instructed last January to close down all their works for a period of one year and at the end of that time a further period of closing down would probably be specified.

New Westminster, B.C.—Wooden ships to the value of approximately one million dollars will be constructed at New Westminster and at other points along the Fraser River according to a contract just let by the Dominion Government. The allotment of the contracts will not be completed until after the Dominion Shipbuilding Commission for British Columbia reaches the Pacific Coast. It is understood that if satisfactory terms are arranged at least two and possibly more ships will be built in New Westminster shipyards. The yards at Coquitlam on the Pitt River will also probably be enlarged and used in connection with this ship construction programme as well as at Eburne and other down-river points.

Canadian Vessel Rammed.—The Canadian freighter Durley Chine, bound in ballast from a Canadian to an American port, was rammed and sunk on the morning of April 22, in collision with an out-bound British freighter, about sixty-five miles east of Sandy Hook. The latter vessel returned to New York with her bow stove in, leaking badly forward, and brought in the captain and the twenty-eight men of the crew of the Durley Chine. She afterwards discharged her cargo and went into dry dock for repairs. According to the captain of the damaged vessel, he left New York the previous afternoon. His vessel struck the Durley Chine amidships and almost cut her in two. The Durley Chine was a single screw steamship of 1,918 gross tonnage, built in Sunderland in 1912, and owned by the Canadian Government. She was 279 feet long, 40 feet one inch beam, and 18 feet 4 inches depth of hold.

Reid Towing & Wrecking Co., has been incorporated at Ottawa, with a capital of $200,000, to carry on the business of towing, salving vessels, etc. Head office is at Montreal, and the incorporators are William K. McKeown, Leopold Choquette, and G. E. Chart, all of Montreal.

St. John's, Nfld.—Inability to obtain steamers to transport their product to England has resulted in the decision of Lord Northcliffe and his assistants to shut down their large paper mills at Grand Falls. It is understood that most of the company's log choppers will take service in the forestry battalions being organized here for timber work in Great Britain.

Three Months' Sinkings.—Three hundred and seventy-one British vessels have been sunk in the three months since the Admiralty began issuing statements without giving the tonnage of vessels. In that period over 65,000 vessels have entered or left British ports. Of the ships sunk, 250 have been of over 1,600 tons, 113 have been below that tonnage, and 108 have been fishing craft.

Steel Firm's Offer to Help Shipbuilding.—Advices from Washington state that Chairman Denman of the Shipping Board said that the steel interests had come forward with the offer to supply 400,000 tons of steel a month to aid in carrying out the Government's program. This information was received with much satisfaction by officials, in view of the situation which had been faced.

Record Price for Boiler Plate.—A report from Philadelphia, Pa., states that another high record of prices has been scored in the phenomenal eastern plate market. A sale of about 500 tons of marine boiler steel for delivery during the next five months has been made at 20 cents per pound, mill, or $400 per ton. Shipment is to be made to a gulf point. This is the highest price for any commercial quality the eastern plate market has developed.

Brockville, Ont.—In the presence of 1,000 spectators the new excursion steamer John Webster was about to be launched at Morristown, when the cribbing of the ways slipped as the new craft was fifteen feet toward the river. The boat settled on land, and all efforts to release it failed. The boat was christened by Miss Clara Garvin, and short speeches were delivered by Mayor Wright, W. A. Lewis, Brockville; A. W. Gregory, F. W. Ames, J. V. Crawford, R. Nicolson and Rev. Mr. Hay, of Morristown. The Webster was built at a cost of $25,000, and is named after Brockville's Federal member. She is 106 feet over all and 26 feet beam. On May 4, success attended the launching effort.

Canadian Canal Traffic.—A Government blue book tabled in the House on May 7, shows that there was an increase of 8,384,688 tons in traffic through Canadian canals during the season of 1916. The total volume of traffic last season was 23,583,491 tons, as against 15,198,803 in 1915. A great increase was shown in the traffic through the canal at Sault Ste. Marie. The total traffic through this waterway during the season of 1916 was 16,813,649 tons, as against 7,770,957 during the previous year. The traffic through the St. Lawrence canals during 1916 totaled 3,368,064 tons, and through the Welland Canal 2,544,964 tons. The total volume of wheat moved through the Soo Canal last season was 185,003,667 bushels, and of this quantity 82,807,342 bushels passed through the Canadian channel. The larger accommodations on the St. Mary's side of the river, says the report, probably accounts for the larger portion of the traffic going through the American channel.

Government Can Requisition Ships.—An Order-in-Council widening the powers of the Canadian Government to requisition ships under the authority of the War Measures Act is contained in a return tabled in the Commons on April 30. This order supersedes two earlier ones which were passed on November 24, 1916, and March 31, 1917. The order passed on April 24, provides that any vessel of Canadian registry, any ship under construction or to be constructed, even if exportation for foreign registry has been authorized, may be requisitioned by or on behalf of His Majesty for any purpose whatsoever. The new order also enacts that cargo space on any British ship registered in Canada may be requisitioned, in whole or in part, for any purpose whatsoever.

Less Meat on Ships.—Members of the Lake Carriers' Association are to do their part toward conservation of the food supply by urging greater economy in the use of foodstuffs on their vessels. A circular prepared by President William Livingstone, and sent to members of the Association, is being transmitted to their vessels. The communication is in part as follows: "The crews of our ships should line up with the housewives of the country, and serve the nation by eliminating all waste of foodstuffs and reducing the consumption of meat. Do you think in these critical times it is necessary to serve meat four times a day, as has become the practice on our lake ships? I appeal to you and to the crews on your ships to practise strict economy by not wasting a particle of food, and intelligently reducing the meat consumption on ships."

TURBINE GEARING

By D. Street.

IN turbine reduction gears for ship propulsion the width of the gear must of necessity be very great as compared with the pitch and the diameter, and wherever this condition exists the difficulty of maintaining an even working pressure over the whole width of tooth surface is enormously increased. The unavoidable minute irregularities in the cutting of the gear may easily cause the burden of the load to be taken by only a small part of the total width of face at a time; the incidence of the load swaying from side to side of the gear at each rotation; while the torque in the pinion itself, which can never be entirely eliminated, may cause that part of the tooth-face nearest the turbine to take permanently an undue share of the duty. From these circumstances spring the liability of the turbine reduction gears to vibration, noise and unexpected breakage, and the necessity for employing gears of a larger pitch, strength, and weight than would otherwise be necessary.

The problem is, however, by no means insoluble. Macalpine was the first to tackle it seriously. His original arrangement was one in which the pinion was carried in a rocking frame which permitted it to give a little under extra pressure at either side, and so maintain an equality of pressure across the tooth-face. Later hydraulic compensating support was substituted for the mechanical support.

Excellent results have been obtained from this method of automatic self-alignment of the pinion to the wheel, but more recently the problem has been attacked from the other side by building a wheel which will adapt itself to the pinion. The gear is built up of a number of plates machined to a form which gives them the desired degree of lateral flexibility. These plates are put together, engaging solidly at the hub, and also engaging on a narrow edge at the periphery. When so built together, they form a solid cylinder, which can be spirally cut in the ordinary manner. After cutting, the edge engagements are relieved with a small dividing tool, so that each disc is operated independently, and is free to deflect laterally under the side pressure which results from its diagonal engagements with the pinion. The parts are so proportioned that this lateral deflection can at no time involve fibre strains which could possibly cause destructive fatigue. A very small amount of this lateral deflection is sufficient to afford the desired distribution of load, and this amount can easily be given without approaching dangerous periodic strains.

The commercial development of this gear is already well advanced. About 72 sets of the gearing have been applied to turbo-generator drives, and some of these have now been in service one and a half years; about seven sets have been fitted to ships which are now in service, some of them having been long voyages. It is stated that in all of this practical experience no case of trouble with gearing has been developed, and no appreciable deterioration of gears has been observed. Contracts are said to have been closed for machinery for the propulsion of 70 ships, aggregating 215,200 horsepower.

Whether self-equalising devices of one kind or another are really essential to efficiency in turbine gearing depends in some measure upon the degree of accuracy which can be reached in the gear cutting process. While the developments with flexible trunnions and wheels have been going forward, important improvements have been made in the method of cutting large gears, whereby the errors in the master wheels are broken up, and so distributed over the surface of the gear as to be practically eliminated.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Capt. B. T. Eastaway, who had commanded several Allan liners, has been killed while in command of one of his Majesty's ships.

Captain R. C. Brown, of the Donaldson liner Cassandra, received the Harbor Commissioners' gold-headed cane, by reason of his having opened the 1917 season of ocean navigation to Montreal on May 1, his vessel coming into port early on that date.

J. H. Welsford, president of the Union Steamship Co., of British Columbia, died recently at his home in Liverpool, England. Mr. Welsford was a prominent shipowner in Great Britain, but frequently visited British Columbia. He purchased a controlling interest in the Union Steamship Co. in 1911.

W. I. Gear, of the Robert Reford Co., Montreal, has agreed to give his services to the Imperial Munitions Board as director of steel shipbuilding, and will deal with all questions relating to the construction of steel merchant ships in this country for the British Government. His office will be in Ottawa.

R. P. Butchart, of Victoria, B.C., who has been appointed director of shipbuilding for British Columbia, will have charge of the building of wooden vessels in that province. **Capt. J. W. Troup**, manager of the British Columbia coast service of the C. P. R., will act as assistant director, with headquarters also at Victoria.

Capt. John Baillies, a well-known seafarer, who has plied for years on the British Columbia coast, has received instructions to report to the senior naval officer at Esquimalt for appointment under the new regulations whereby master mariners are taken into the naval service with the rank and pay of "skipper." Captain Baillies is a deepwater man, but for many years has been in the coasting service, and at present he is with the G.T.P.

MONTREAL SAILORS' INSTITUTE ANNUAL

THE fifty-ninth annual report of the Montreal Sailors' Institute, submitted by the retiring president, R. W. Reford, disclosed, among other things, that the transatlantic arrivals at the port of Montreal showed an increase for the year of nearly eighteen per cent. In placing the annual statement before the meeting, Mr. Reford said in part:—

"The exigencies of the war continued to more or less seriously affect the shipping of the port, as it no doubt will do until the war's close, yet the transatlantic arrivals increased nearly eighteen per cent. The decrease of vessels in the coal trade and with the Maritime Provinces amounted to over sixty-one per cent. The number of seamen manning the vessels amounted to about eight per cent. less than during the season of 1915. The aggregate attendance at the institute showed a slight increase, however.

"The worth of the men of the sea to whom the institute caters was splendidly emphasized by the First Civil Lord of the Admiralty, Sir Edward Carson, when, in a recent speech before the House of Commons, Sir Edward was speaking of the submarine menace. He quoted the number of sinkings during the previous three months and then added: 'In the face of all these sinkings and the accompanying sacrifices and trials, I have not heard of a single sailor who has refused to sail.' Admiral Lord Jellicoe gave utterance to the same fact when he stated in a recent address that the 'magnificent bravery displayed by the officers and men of the mercantile marine during the conduct of the war had simply astounded the world.'

"The reports show how the institute attempts to fulfil the duties of hospitality which we owe to these brave men who undertake so much to keep the trade routes open to commerce. Among the many friends of the Institute who have been lost at sea during the year, mention might be made of Captain John Matthias, of the Laurentic; Captain Eastaway, of the Ionian, and Captain John Mitchell, of the Cabotia.

"Not only has the hand of death been busy with the men of the sea, but we

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. A. Wright, Toronto. **Secretary**—Francis King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio. Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York. **Secretary**—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I. Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

1917 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand,	93 Fifth Avenue, Lachine, P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	176 King Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

regret to record that a number of the Institute's supporters in the city have been removed from us by the grim reaper. These include T. J. Drummond, E. B. Greenshields, Hon. Senator Robert McKay, David McNicol, David Morrice, Lt. Elliot Sutherland, and Bo's'n William H. Grant."

Small Deficit Shown

The financial statement, which was read by J. Ritchie Bell, manager, showed a small deficit, amounting to $65, on the year's operations. It was moved by James Rodger, seconded by Capt. Bales, that the officers for the ensuing year be as follows: —Col. Bart. McLennan, overseas, president; Abner Kingman and Lansing Lewis, vice-presidents; A. F. C. Ross, honorary treasurer; Capt. Jas. N. Bales, hon. secretary; J. Ritchie Bell, manager; Mrs. Margaret Ritchie Kerr, assistant manager, and Andrew C. Kerr, office secretary. The following constitutes the Board of Management: Thos. Harling, D. W. Campbell, R. B. Morrice. Andrew A. Allan, E. W. Foulds, J. M. M. Duff, Capt. Clift, Capt. Walsh, Alex. McFee, Guy Tombs, Capt. Bales, James Rodger, R. S. Logan, George Hodge, P. V. G. Mitchell, A. F. C. Ross, John Torrance, W. I. Gear, R. W. Reford, Capt. Reid, J. R. Binning, Farquhar Robertson, J. C. Holden, M. McD. Duff, Thomas Henry, J. K. L. Ross, J. W. Norcross.

A satisfactory report of the entertainment committee was likewise submitted. Mr. Reford then moved, seconded by Capt. Clift, that the reports be adopted.

After the business of the year had been disposed of, an entertainment of songs and dances, followed, in which good talent was revealed. Among those taking part were Miss Inez Lee, who sang patriotic songs: Fred Brookes and Jack Longley, with Miss Grace Grant, was at the piano.

Among those present were: Mr. R. W. Reford, in the chair; Sir John Kennedy, Lansing Lewis, Jas. Rodger, W. G. Ross, M. Fennel. jr.: A. F. Cross. Capt. Bales. Capt. Clift. Capt. Reid, Dr. Atherton, and M. H. Gault.

SUB DEPREDATIONS EBBING

EIGHTEEN British merchant vessels of more than 1 600 tons were sunk during the past week, says the official summary of shipping losses issued on May 16. Five merchant ships of less than 1,600 tons were sunk, together with three fishing vessels. The following constitutes the general summary:—

All nationalities—Arrivals, 2,568; sailings, 2 522.

British vessels, mined, submarined and sunk, over 1,600 tons, including one previously. 18; under 1,600 tons, 5.

British merchantmen unsuccessfully attacked. including five previously, 19.

British fishing vessels sunk, 3.

The foregoing statement shows that the losses for the week were cut considerably more than half, as regards the number of vessels sunk from the previous week's report, which showed 62 vessels, as compared with 26 in the current statement.

Canadian Vessels, Captains and Chief Engineers

As in former years we have pleasure in recording in our columns the list of navigation season 1917 lake, river and ocean coasting vessels, together with the names of their principal officers.

PLUNKETT NAVIGATION CO., COBOURG, ONT.

Vessel	Captain	Chief Engineer
J. W. Follette	H. Redfern	John McFaul

SPARROW LAKE STEAMER LINE, SPARROW LAKE, ONT.

Vessel	Captain	Chief Engineer
Glympse	A. F. Stanton	G. T. Stanton

VALLEY STEAMSHIP CO., ANNAPOLIS ROYAL, N.S.

Vessel	Captain	Chief Engineer
Granville	C. W. Collins	James McCullough

CITY OF THREE RIVERS, QUE.

Vessel	Captain	Chief Engineer
Le Progres	N. W. Lewis	A. Frenette

WINDSOR AND PELEE ISLAND STEAMSHIP CO., PELEE ISLAND, ONT.

Vessel	Captain	Chief Engineer
Pelee	J. N. Sheats	J. R. Ferguson

WESTERIAN TRANSPORTATION CO., OTTAWA, ONT.

Vessel	Captain	Chief Engineer
Westerian	A. Lefebvre	J. Lalalee

VICTORIA NAVIGATION CO., THURSO, QUE.

Vessel	Captain	Chief Engineer
Victoria	F. Elliott	P. Belanger

STEAMER PREMIER, SAULT STE. MARIE, ONT.

Vessel	Captain	Chief Engineer
Premier	W. Hyland	J. Howson

PENNSYLVANIA-ONTARIO TRANSPORTATION CO., CLEVELAND, OHIO.

Vessel	Captain	Chief Engineer
Ashtabula	C. F. Meyers	S. M. Sylvester

PEMBROKE TRANSPORTATION CO., PEMBROKE, ONT.

Vessel	Captain	Chief Engineer
Oilseau.	Jos. Tessier	J. Trottier

CANADIAN PACIFIC CAR AND PASSENGER TRANSFER CO., PRESCOTT, ONT.

Vessel	Captain	Chief Engineer
Charles Lyon	W. Henry	L. Black

CENTRAL CANADA COAL CO., BROCKVILLE, ONT.

Vessel	Captain	Chief Engineer
Samuel Marshall	W. A. Tullock	W. H. Keir

GLOUCESTER NAVIGATION CO., CARAQUET, N.B.

Vessel	Captain	Chief Engineer
Beaver	F. Hache	E. H. Haviland

CANADA ATLANTIC AND PLANT LINE STEAMSHIP CO., HALIFAX, N.S.

Vessel	Captain	Chief Engineer
Halifax	H. Doyle	R. Mackay

GASPE AND BAIE DES CHALEURS STEAMSHIP CO., LTD., QUEBEC, QUE.

Vessel	Captain	Chief Engineer
Gaspesian	Jos. Vezina	N. Protomastro

INTERNATIONAL TRANSIT CO., SAULT STE. MARIE, ONT.

Vessel	Captain	Chief Engineer
Algoma	F. Frech	C. Innes

KEENAN TOWING CO., OWEN SOUND, ONT.

Vessel	Captain	Chief Engineer
Keenan	J. Rutherford	W. Owens

LAKE ERIE NAVIGATION CO., WALKERVILLE, ONT.

Vessel	Captain	Chief Engineer
Marquette and Bessemer No. 1	J. A. Patterson	H. Culp

MARITIME STEAMSHIP CO., BLACKS HARBOR, N.B.

Vessel	Captain	Chief Engineer
Connors Bros.	E. H. Warnock	G. Cowie

MARQUETTE AND BESSEMER DOCK AND NAVIGATION CO., WALKERVILLE, ONT.

Vessel	Captain	Chief Engineer
Marquette and Bessemer No. 2	John Vanbuskirk	T. Elliott

ISLAND TUG CO., CHARLOTTETOWN, P.E.I.

Vessel	Captain	Chief Engineer
Harland	J. T. McLaine	A. Roebuck

TORONTO, HAMILTON AND BUFFALO NAVIGATION CO., HAMILTON, ONT.

Vessel	Captain	Chief Engineer
Maitland No. 1	B. T. Haagenson	C. E. Sylvester

NEWCASTLE STEAMBOAT CO., NEWCASTLE, N.B.

Vessel	Captain	Chief Engineer
Dorothy N.	C. S. Amos	A. McLean

GRAND MANAN STEAMSHIP CO., GRAND MANAN, N.B.

Vessel	Captain	Chief Engineer
Grand Manan	J. A. Ingersoll	J. F. McGray

C. P. R. BAY OF FUNDY SERVICE, ST. JOHN, N.B.

Vessel	Captain	Chief Engineer
Empress	A. MacDonald	J. M. Pendrigh

HALIFAX AND CANSO STEAMSHIP CO., HALIFAX, N.S.

Vessel	Captain	Chief Engineer
Scotia	Jas. Schmeisser	Jos. Clark

HALIFAX AND INVERNESS STEAMSHIP CO., HALIFAX, N.S.

Vessel.	Captain.	Chief Engineer.
Strathlorne	J. Munro	J. Latham

In large vessels the decrease was from 24 to 18. The most marked drop, however, was in the number of smaller vessels destroyed. The high water mark in the destruction of large vessels was reached in the report of April 26, when forty such vessels were announced as destroyed.

PORT ADVANTAGES OF VANCOUVER, B.C.

THE Secretary of the Vancouver Board of Trade has issued a notice to the effect that the people of British Columbia, and especially of the port of Vancouver, are anxious to promote closer relations with British shipowners. This matter has engaged the earnest attention of their Board of Trade, and at a recent meeting it was resolved to communicate with the leading shipowners in Great Britain with a view to securing, as far as possible, their cooperation. Their desire is to promote the policy of making Vancouver, which is the principal British port in the North Pacific, the headquarters of British shipping on that coast.

It is pointed out that the Dominion Government has just completed a large dock and grain elevator, and further extensive improvements and facilities are planned for shipping, including a large dry dock. The Vancouver Board of Trade has petitioned the Dominion Government to make the harbor of Vancouver a national free port. The harbor facilities will be found equal to any on the coast, but they do not, at this time, wish so much to suggest the exclusive advantages of Vancouver as a loading port as the advantages of establishing a branch office in Vancouver for the management and chartering of vessels engaged in Pacific Coast trade. If shipowners opened their own offices in Vancouver it would be an important help in developing the trade and resources of that Province by putting it more closely in touch with freighting facilities, and, at the same time, it is considered that it would not prejudice but facilitate trading from other ports on the coast.

The actual expense of opening an office in Vancouver, it is thought, would be offset by the greater efficiency of local control, and it is believed that a measure of decentralization would both promote the solidity of the Empire and the interests of British shipowners. Amongst the advantages put forth are: The proximity of the best bunker coal on the coast. The ability to co-operate with Canadian railroads, and to divert to this British port much traffic, which can be shipped to advantage by way of Vancouver to and from the Orient, including Asiatic Russia and Australia; the adequate facilities and low port charges of Vancouver.

TRADE GOSSIP

Mason Regulator & Engineering Co.—A new company has been organized in Montreal, under the name of Mason Regulator & Engineering Co., and has taken over the well known steam specialty business of H. L. Peiler & Co. there. The new company has also acquired the Canadian business of the Griscom-Russell Co. Eldon Macleod, treasurer of

HALIFAX AND SHEET HARBOR STEAMSHIP CO., HALIFAX, N.S.

Vessel	Captain	Chief Engineer
Margaret	W. Cooper	J. Jackson

CHATHAM NAVIGATION CO., CHATHAM, ONT.

Vessel	Captain	Chief Engineer
Ossifrage	T. J. Stockwell	G. Peel

PEACE RIVER NAVIGATION CO., EDMONTON, ALTA.

Vessel	Captain	Chief Engineer
Northland Call	S. J. Coolen	....

MONTREAL AND CORNWALL NAVIGATION CO., CORNWALL, ONT.

Vessel	Captain	Chief Engineer
Britannic	A. Anderson	N. Marchand
St. Laurent	J. Leroux	A. Cote

UNITED STATES AND DOMINION TRANSPORTATION CO., CHICAGO, ILL.

Vessel	Captain	Chief Engineer
America	E. C. Smith	F. McMillan
Easton	G. Exe	....

J. F. SOWARDS, KINGSTON, ONT.

Vessel	Captain	Chief Engineer
M. M. Shaw	H. N. Jex	W. McCabe
M. A. Lydon	P. Clark	M. Moon
Shanly	J. F. Sowards	John Maloney

PENINSULA TUG AND TOWING CO., WIARTON, ONT.

Vessel	Captain	Chief Engineer
Crawford	W. D. Bain	R. H. Isbester
Homer Warren	F. Wood	W. C. Fox

PORT COLBORNE TUG CO., PORT COLBORNE, ONT.

Vessel	Captain	Chief Engineer
J. V. O'Brien	D. McGrath	....
Meteor	John McGrath	....

NIAGARA, ST. CATHARINES AND TORONTO NAVIGATION CO., ST. CATHARINES, ONT.

Vessel	Captain	Chief Engineer
Dalhousie City	J. W. Maddick	J. H. Brown
Garden City	G. Blanchard	H. R. Welch

PRESCOTT AND OGDENSBURG FERRY CO., PRESCOTT, ONT.

Vessel	Captain	Chief Engineer
Miss Vandenburg	H. Black	W. J. Jenks
	S. J. Delaney	

MIDLAND TRANSPORTATION CO., MIDLAND, ONT.

Vessel	Captain	Chief Engineer
C. W. Chamberlain	W. Staker	G. Kerr
Lucknow	A. Cuff.	H. Schmidt

THE LEVIS MARITIME AND INDUSTRIAL CO., LEVIS, QUE.

Vessel	Captain	Chief Engineer
Champion	D. Lemay	C. Barras
Frontenac	Jos. Plante	P. Plante

FARRAR TRANSPORTATION CO., TORONTO.

Vessel	Captain	Chief Engineer
Collingwood	John Ewart	D. McLeod
Meaford	J. Lewis	T. W. Verity

W. HANNA & CO., PORT CARLING, ONT.

Vessel	Captain	Chief Engineer
Mink	W. H. McCulley	....
New Minko	J. J. McCulley	J. S. Barry

BATHURST LUMBER CO., BATHURST, N.B.

Vessel	Captain	Chief Engineer
Betty D.	A. Hains	R. Kane
Nipisiguit	F. Curwin	L. Spragg

CHICAGO, DULUTH AND GEORGIAN BAY TRANSIT CO., CHICAGO, ILL.

Vessel	Captain	Chief Engineer
North American	E. Taylor	J. F. Buritz
South American	G. M. Cummings	W. F. Johnson

WALKERVILLE AND DETROIT FERRY CO., WALKERVILLE, ONT.

Vessel	Captain	Chief Engineer
Ariel	W. H. Corr	H. Anderson
Essex	J. E. Rathbun	P. McLaren

C. P. R. DETROIT RIVER CAR FERRIES, WINDSOR, ONT.

Vessel	Captain	Chief Engineer
Michigan	H. Farrow	F. Merrill
Ontario	R. Brown	C. A. Sullivan

ONTARIO CAR FERRY CO., MONTREAL.

Vessel	Captain	Chief Engineer
Ontario No. 1	S. McCaig	D. L. Smyth
Ontario No. 2	F. D. Forrest	J. A. Nicoll

OTTAWA RIVER NAVIGATION CO., MONTREAL.

Vessel	Captain	Chief Engineer
Duchess of York	....	N. Charter
Empress	A. Blondin	A. L. deMartigny

NORTH VANCOUVER FERRY CO., NORTH VANCOUVER, B.C.

Vessel	Captain	Chief Engineer
North Vancouver No. 1	W. Fatke	E. N. Kendall
North Vancouver No. 2	R. R. Spicer	D. Becker
North Vancouver No. 3	W. J. Spraclin	J. W. Withworth

TERMINAL STEAM NAVIGATION CO., VANCOUVER, B.C.

Vessel	Captain	Chief Engineer
Ballena	J. A. Cates	A. Pirie
Bowena	F. W. Gilbert	Jas. Adams
Britannia	J. W. Cates	C. McFarlane

COAST STEAMSHIP CO., VANCOUVER, B.C.

Vessel	Captain	Chief Engineer
Celtic	John Finlay	H. Buxton
Clansman	C. Anderson	H. Nissen
Coaster	M. F. MacDonald	D. MacDonald

CANADA ATLANTIC TRANSIT. CO., MONTREAL.

Vessel	Captain	Chief Engineer
Arthur Orr	J. H. Fleming	D. E. Mance
Geo. N. Orr	J. Simons	J. B. Wellman
Kearsage	H. Jaenke	F. Wilks

the Mason Regulator Co. of Boston, Mass., is president, while H. L. Peiler will act as treasurer and general manager. It is the intention of the new company to manufacture, in Canada, Mason reducing valves and other pressure regulating appliances, as well as "Bundy" steam traps and "Coppus" blowers besides the marine and steam specialties of the Griscom-Russell Co. These include the well known Reilly heaters, evaporators and distillers which enter so largely into marine equipment. All the other agencies controlled by H. L. Peiler & Co., will be retained, the business being carried along on the same lines as heretofore. The new company will have a greatly strengthened organization. Associated with Mr. Peiler will be E. J. Hatton, formerly of the Canadian Allis Chalmers Co., who will have charge of the manufacturing and erection work, while the sales end will be taken under Mr. Peiler's supervision, by E. T. Jeffrey, formerly of the John McDougall Caledonian Iron Works, and H. E. Kirkham. The Toronto office will be in charge of J. Collins, late manager of the Canadian Steam Boiler Equipment Co., who is well known to the engineering fraternity in Toronto. The offices of the old firm at 380 St. James St., Montreal, have been overhauled and additional space acquired for taking care of the increased business anticipated.

CATALOGUES

Band Ship Saw.—The J. A. Fay & Egan Co., Cincinnati, Ohio, are distributing copies of a new bulletin, M-19, describing No. 311 "Lightning" band ship saw, which is a new machine designed to meet present day ship-building requirements. The principal features of this band saw are dealt with fully, accompanied by illustrations showing the machine set at various angles.

Steam Pumps.—The G. H. Tod Co., Toronto, have issued a new booklet giving the practical ratings for the Tod-Attwood patent steam pumps. The tables have been carefully compiled and will be of great assistance to the prospective purchaser in selecting the correct size of pump for various classes of work. The tables show at a glance the capacity of each size of pump at different piston speeds.

Searchlight Projectors.—An interesting catalogue has recently been issued by Crompton & Co., Chelmsford, England dealing with searchlight projectors for naval and military and general purposes. The catalogue contains a general description covering a wide range of sizes of standard searchlight projectors including particulars of the main features of their construction. The various types are illustrated and particulars given regarding current and range etc.

CAPE BRETON ELECTRIC CO., SYDNEY, N.S.

Vessel	Captain	Chief Engineer
Electronic	I. H. Lewis	B. Dixon
Hygeia	A. McLeod	....
Peerless	G. Dicks	J. B. Weeks

WEST VANCOUVER FERRY CO., VANCOUVER, B.C.

Vessel	Captain	Chief Engineer
Doncella	D. Smith	R. W. Pine
Sonrisa	J. Watson	J. G. Gale
West Vancouver No. 5		W. E. Thompson

ROSS NAVIGATION CO., PAS, MAN.

Vessel	Captain	Chief Engineer
Brisbin	H. L. Weber	H. Carefoot
Minasin	A. Deacon	T. Paquette
Nipawin	H. H. Ross	J. Shannon

MIRAMICHI STEAM NAVIGATION CO., CHATHAM, N.B.

Vessel	Captain	Chief Engineer
Alexandra	Jas. Nowlan	Jas. Walls
Miramichi	J. P. Bullick	N. Smith
Sybella H.	H. Copp	A. McIntyre

CANADIAN GOVERNMENT RAILWAYS, MONCTON, N.B.

Vessel	Captain	Chief Engineer
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Northumberland	A. Cameron	C. Cumming
Prince Edward Island	J. J. Murchison	R. L. Unswort
Scotia No. 2	R. L. Maguire	W. Anderson

G. T. P. COAST STEAMSHIP CO., VANCOUVER.

Vessel	Captain	Chief Engineer
Prince Albert	W. S. Morehouse	A. S. Munro
Prince George	D. Donald	I. O. Handy
Prince John	A. M. Davies	R. Know
Prince Rupert	D. Mackenzie	R. Bell

ROYAL MAIL STEAM PACKET CO., HALIFAX, N.S.

Vessel	Captain	Chief Engineer
Caraquet	W. H. Lainson	W. Hobson
Chaleur	T. A. Hill	P. Tubbs
Chaudiere	F. Willan	A. L. Bennee
Chignecto	C. Adam	W. J. Mitchell

PORT HURON AND SARNIA FERRY CO., PORT HURON, MICH.

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Hiawatha	E. M. Thomas	H. Myers
James Beard	G. Waugh	G. Muler
O. D. Conger	W. S. Major	R. Cameron

NORTHERN NAVIGATION CO., SARNIA, ONT.

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Huronic	A. M. Wright	J. McLeod
Noronic	R. D. Foote	S. Brisbin
Waubic	J. Dube	U. Brisbin

COAST STEAMSHIP CO., VANCOUVER, B.C.

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British Columbia	J. M. Hewison	J. Ellison
Henriette	O. Buchholz	A. Hewitt
Turret Crown	J. Park	J. McG. White

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McKenzie River	Patton	G. A. King

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Saskatoon	N. McGlennon	J. A. McDonald

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Keyvive	L. Beaupre	Jas. Boak
Keywest	A. Barrett	R. Knight

of all sizes. The concluding pages contain information covering special attachments and applications.

Modern Steam Disinfection is the title of a catalogue issued by the Grampian Engineering Co., Stirling, Scotland, and featuring the "Velox" steam disinfectors for hospitals and military camps, etc. The catalogue is arranged in two main sections. The first part compares various methods of physical disinfection explaining the development of the steam process and its principal features. Then follows a full description of the "Velox" apparatus including details of construction covering both high and low pressure disinfectors. The combined high-pressure steam and vacuum-formalin process is next dealt with fully with method of operation. The second part of the catalogue contains a representative list of standard types and sizes of the "Velox" steam and combined disinfectors. The various types, stationary, portable and marine are described and illustrated; the class of service for each type is also stated. A report of tests concludes a well arranged catalogue.

BOOK REVIEW

Jane's Fighting Ships, 1916, by the late Fred T. Jane, 449 pages, 12 x 7½ in. Published by Sampson Low, Marston & Co., London, England, price $5.25. This well known encyclopedia of the navies of the world is now in its nineteenth year of issue. This edition is new and complete, and has been sanctioned by the British Admiralty. In this edition the details of the British Navy have been reinstated, but without photographs and illustrations, and omitting, of course, any feature that might be of assistance to the enemy. The changes in this issue are suggestions of the late Mr. Jane, and have been carried out under the direction of Maurice Prendergast. A large number of new illustrations in the form of photographs, plans and silhouettes have been added, while many new maps of ports and harbors, brought into prominence by the war, have been included. Sections devoted to various navies have been enlarged and generally improved, while some very useful information has been included on German submarines. In spite of the restrictions imposed by the war, the book contains a great deal of valuable and interesting information. In regard to the British ships, although the illustrations and silhouettes have of necessity been omitted, particulars covering armament, machinery and general features are included. A list of illustrations of ships of all nationalities lost in the war is contained in the opening pages. The book has a list of contents and a general index, the latter being a list of ships of all navies. Additional to the 449 pages of reading matter are 161 pages of advertisements forming a useful directory of shipbuilders and manufacturers. The book is printed on coated paper and bound in substantial cardboard covers.

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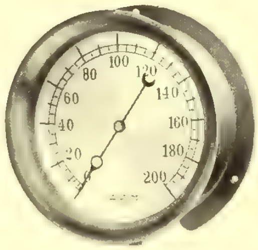

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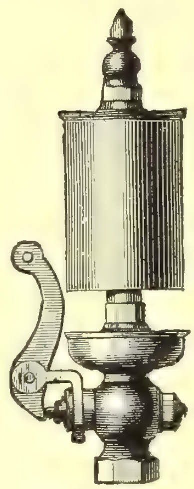

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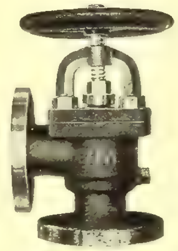

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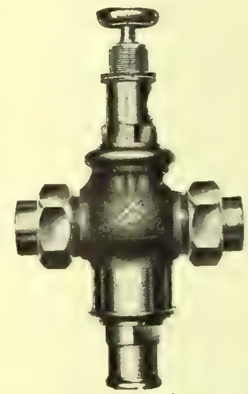

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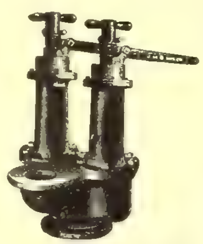

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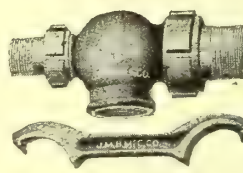

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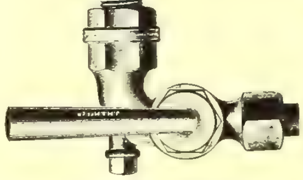

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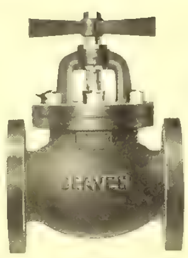

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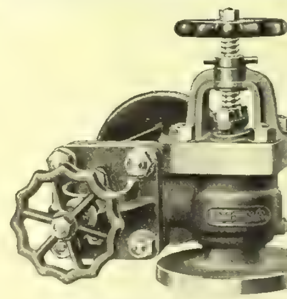

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MARINE ENGINEERING of Canada

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World. Published by The MacLean Publishing Co., Limited

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Vol. VII. Publication Office, Toronto—June, 1917 No. 6

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Development of Ocean Service Shipbuilding in Canada--IV.

By C. T. R.

In addition to the widespread requisitioning of vessels for transportation purposes by the Allies, the war attendant and normal merchant ship losses and the many months' almost complete cessation of new construction on the part of the latter, the merchant marine of the world has had the misfortune to become to a large extent the target for enemy submarine activity. All nations have suffered in this respect, hence the almost feverish anxiety being displayed by shipping interests to have the losses made good at the earliest possible moment.

S.S. "WAR DOG" LAUNCHED AT NORTH VANCOUVER

With the successful launching of the War Dog from the Wallace Shipyards, North Vanceuver, B. C., on May 17, another stage towards the completion of the first steel ocean-going ship yet built in British Columbia, was reached. The vessel is 300 feet long between perpendiculars, 45 feet moulded beam and 27 feet moulded depth, and is of the well-decked type designed to carry 4,700 tons deadweight. Work of this class would not, in older districts, attract much attention; but as only a few years ago fir and cedar trees of the largest size grew where the War Dog was built, special interest attaches to what has been accomplished, not only in a local sense, but in its broader and national aspects. Launches and trial trips have, of course, taken place from the Wallace Shipyards before, but only on this occasion was a general holiday proclaimed. A large number of guests were entertained by the management in their characteristic style and as the vessel started down the ways to the waters of Burrard Inlet, she was christened by Miss Barbara Hogg, of Vancouver.

The War Dog has been built to take Lloyd's highest class and has been, during construction, under the supervision of T. G. Mitchell, Lloyd's representative in Vancouver, while H. Darling has acted as owners' representative. The boat was originally laid down for Japanese interests, but has since been taken over by a Liverpool, England shipping firm. The original contract was placed by Messrs. Dingwall, Cotts & Co. The main engines have been built by the Wallace Shipyards in their own shops. They are of the three crank triple expansion type, having cylinders 24 in.-38 in.-62 in. diameter, by 42 in. stroke, and at 70 revolutions per minute will be capable of developing 1,300 indicated horse-power. The propeller is built up, having a cast iron boss and four cast iron blades, its diameter being 15 ft, and its pitch adjustable from 14 ft. 6 in. to 16 ft. 6 in. The main boilers were built by Messrs. J. G. Kincaid & Co., of Greenock, Scotland. They are of the Scotch marine type, 14 ft. 9 in. mean diameter by 11 ft. 0 in. long, and carry 160 pounds working steam pressure. The donkey boiler is also of the marine type, 6 ft. in diameter by 8 ft. 5 in. long, and was built by the Vulcan Iron Works, New Westminster, B.C. The deck winches have all been supplied by the North Shore Iron Works, Ltd., of North Vancouver. The machinery was all ready to install, in fact, all the auxiliaries that could be put aboard previous to launching were in place and piped up. The work of installing the main engines and boilers is being rushed to completion, three shifts of men being employed. The large sheer legs belonging to the builders and capable of lifting 100 tons will take care of the heavy lifts.

BOW VIEW OF "WAR DOG" ON THE WAYS.

Much credit is due to the staff of the Wallace Shipyards for their accomplishment. Earlier in the war, before the shipping situation was thoroughly understood the firm was engaged in shell production. On completion of their contract, it was evident that more general good would result by getting back to their regular line of work, which they immediately proceeded to do. On the berth vacated by the War Dog, a similar keel was immediately laid down, work in the drawing office and mold loft for this second ship being now well advanced.

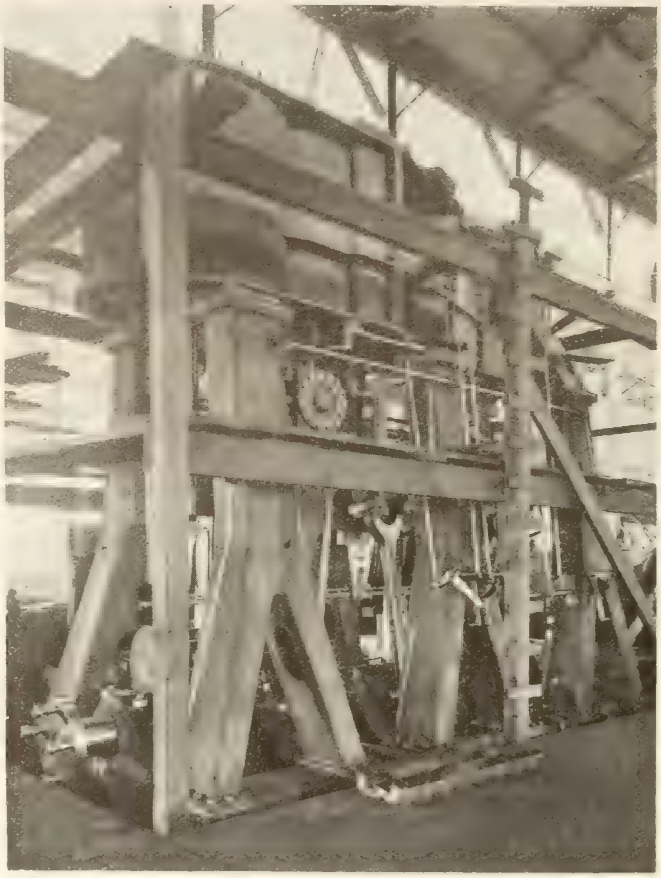
Besides steel construcion, the Wallace yards have sev-

eral auxiliary power schooners under way. At the time of writing they have had two schooners delivered, one was having the machinery and rigging installed, while three were approaching the launching stage. A large amount of local and deep sea repair work is also carried out at North Vancouver, the firm having two marine railways which are more or less constantly employed. Work at No. 1 yard where the steel construction is carried out, is under the charge of R. E. Ellis. H. B. Taylor, the assistant superintendent and chief engineer, has direct charge of the machinery end.

Congratulations Extended

That British Columbia is doing work of great Imperial importance by building ships was the sentiment expressed on the evening of May 13, at the Vancouver Club when Mr. Eadie, on behalf of Dingwall, Cotts & Co., the firm which placed the order for the War Dog, was host at a dinner to celebrate the successful launching of the vessel the previous afternoon. The Wallace Shipyards, the builders, were represented by Alfred Wallace, R. Elwood Ellis, superintendent; H. Bakewell Taylor, engineer-in-chief, and James D. Baker, naval architect. Others present were, Messrs. Henry Darling, W. E. Hodges, J. M. Bowell, W. H. Hogg, James Hopkins, Ed. E. Sykes, A. H. Sperry, Frank R. Harrison, George Kidd, E. W. Hamber, F. W. Peters, E. H. Beazley, Charles S. Meek, Captain C. H. Nicholson, E. J. Leveson, George V. Holt, Robert J. Borland, P. R. Duncan, H. M. Ellis, J. K. Macrae, W. W. Berkinshaw, B. W. Greer, Knox Walkem, T. W. B. London, and C. F. Boyce.

The evening was devoted to talk of shiping and Mr. Eadie expressed the thanks of the community to Mr. Wallace for his courage and enterprise in establishing such an important industry. The ships are afloat and some are en passage, said Mr. Eadie. In submitting the toast, he also paid high tribute to R. Elwood Ellis and Mr. Taylor for their services.



THREE-CYLINDER TRIPLE EXPANSION ENGINES OF THE "WAR DOG" ERECTED IN SHOP.

Various speakers paid compliments to these officials, and a general sentiment was expressed that by building ships British Columbia can be of valuable service to the Emipre. In this connection Mr. Eadie submitted a toast to the men of the British merchant service who have kept the commerce of the Empire moving despite the dangers from submarines and mines, in addition to the ordinary perils of the sea. The toast was responded to by Mr. London and Mr. Beazley.

Bankers' views were given by Mr. Hogg and Mr. Holt, while Mr. Knox Walkem spoke on wooden ships. A toast to the popular host was submitted by F. W. Peters. Unfortunately, Captain Craven, who will command the War Dog, and Chief Engineer Thom who will have charge below, were unable to be present, but there were many kindly references to them.

ACCIDENT PREVENTION IN SHIPYARDS

THE accident-history of shipbuilding on this continent closely follows that of European countries, where the industry has a high rank among dangerous occupations. A little study of the conditions under which modern shipbuilding is carried on will show why the accident rate is so high, and a little further study will show that many of the accidents are wholly unnecessary.

OCEAN SERVICE STEEL FREIGHTER "WAR DOG" TAKING THE WATER AT NORTH VANCOUVER, B.C.

Many of the operations in the modern shipyard, where steel is the chief structural material, are quite different from those that were in vogue in the good old days of the wooden "wind-jammer"; but the changes that have been made have not greatly altered the nature of the hazards to which the men are exposed, and most of the injuries are still due to falls, or to blows from falling objects. The details of shipbuilding vary from yard to yard, according to the magnitude of the operations, the age of the plant, and the experience and personality of the owner or manager. We believe, however, that the practices and suggestions outlined below are fairly applicable to average yards and conditions, says the Travellers' Standard.

FIG. 1. A THREE-DECK STAGING. THE BOARDS ARE LAID LOOSELY AND NO GUARD RAILS ARE PROVIDED.

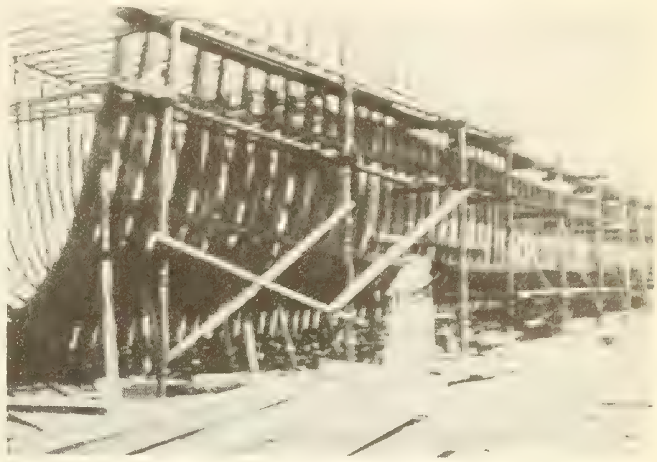


FIG. 2. NEARER VIEW OF A THREE-DECK STAGING.

Staging Feature

Blocks for supporting the keel are first placed on the ground previously prepared, and supports for a scaffold or staging are then erected around the entire space to be occupied by the ship. From an accident-prevention standpoint the staging is one of the most important things in shipbuilding, because a great deal of plate-erecting, riveting, caulking, and painting must be done from it. In the commonest method of staging-construction, two parallel rows of uprights are set in the ground a few feet apart, each upright being provided, from top to bottom, with a series of holes through which bolts may be passed. The bolts support horizontal wooden stringers or cross-pieces, upon which the plank platform of the staging rests. As the work on the ship progresses, the bolts are usually shifted to higher holes and the platforms raised to new levels, though sometimes the old platform is retained and a new one is laid higher up. (In some yards special stagings with metal supports are used, but the safety problem is much the same.)

In many shipyards the men who work on the staging are paid by the piece or area system, and they must raise or lower the staging-platforms themselves. As the shifting of a platform is unremunerative work, it is performed as quickly as possible, and not always with safety in mind. In fact, the accident rate from poor staging became so high, at one time, that a number of shipbuilding companies have placed their staging work in charge of men specially trained to it—nobody else being allowed to move the platform, nor to alter the structure in any other essential way. This plan has worked out very well, largely because these men realize that they will be held responsible for all accidents due to faulty staging.

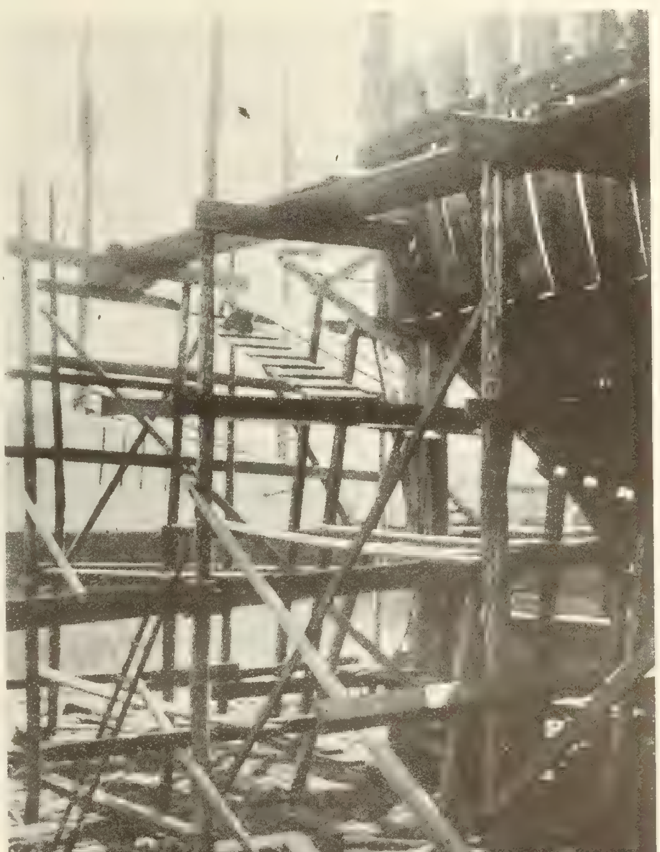


FIG. 3. FOUR DECK STAGING AT STERN OF SHIP. NOTE THE CLEATED RUNWAY LEADING FROM THE THIRD TO THE FOURTH STAGING.

Worn or Damaged Planks and Timbers

One specially marked feature of permitting or compelling the regular workmen to maintain their own staging is the propensity of such men to use timber and planks that are worn out or badly damaged, or defective in some other way, instead of taking the time and trouble to procure sound and suitable material. Planks and timbers that are seriously warped, split, or otherwise badly damaged, should be sawed up or removed from the premises, in order to prevent improper use being made of them. A responsible staging gang, knowing what constitutes a safe working condition and what they have on hand to meet certain requirements, is far less likely to use unsuitable materials.

Men working on a staging often fall from the back of the platform—that is, from the edge that is away from the ship. It is easy to prevent an accident of this kind by erecting a stout railing along the outer row of uprights. A footboard should also be used, and wire-netting between the two is strongly recommended in addition. The railing has been quite generally omitted, mainly because of the time required to install it and remove it. This objection, which is as old as as scaffolding itself, is not a sound one, because the gain from using the railing is out of all proportion to the trouble and expense involved in putting it up. The man who thinks it is not worth while takes this view because he is sure he will not have an accident; but it is a matter of common knowledge

that accidents of this kind occur every little while, and it is much better to be safe than to be sorry. In fact, being sorry doesn't do anybody any good.

In some yards plank shelves are put up in place of guard-rails. This is a good plan, because a strong and properly-located shelf affords protection to the men, and it can also be used for the storage of tools, rivets, bolts, paint-cans, brushes, and small materials of all kinds. The shelf should be guarded by a board on each edge, however, to prevent objects resting upon it from falling off.

The platform planks of ship stagings should be laid with special care. To avoid all chance of tipping, they should never be allowed to project at their ends more than one foot beyond a firm and solid support; and the men who have charge of the laying of the platform should make sure that there are no "traps," or points at which the planks can tip between supports, so that the men can fall through the platform to the ground.

Staging Attachment to Supports.

The platform planks of ship stagings are seldom secured to their supports, except at points where considerable work must be done without disturbing the staging. This is because the men desire to avoid the extra labor involved in shifting the platforms, when the planks are fastened down, and also because it is often necessary to move some of the planks nearest the ship to facilitate the hoisting of plates and other materials into place. The fastening of the planks is far more important in connection with ship scaffolding than it is in connection with the building of an ordinary brick wall, because the jar of the riveting machines and hammers may cause the planks to shift or "creep" until they come into dangerous positions, even though they were correctly placed at the outset. It is well worth while to strap or clamp them to their supports, or to make them secure in some other equally effective way. One method that has been tried with considerable success consists in boring holes through the ends of the planks and through the cross-bars or stringers that support the platform—the cross-bars being made extra wide in this case, to allow for the weakening due to the holes. When a plank is laid down, it is placed so that the hole in one end of it comes directly over a hole in the supporting stringer, and a bolt is slipped through the two, so that the plank cannot shift its position. No nuts are used, and the holes in the platform planks are countersunk, to receive the heads of the bolts. A plank that is secured in this way can be taken up without any trouble.

FIG. 4. STAGING FOR THE INTERIOR OF A VESSEL. IN LAYING THE PLANKS, GREAT CARE MUST BE TAKEN TO SUPPORT THE ENDS SO THAT THE PLANKS WILL NOT TIP WHEN STEPPED UPON.

Much of the interior work, such as the erection and plating of bulkheads, is performed by means of ladders, or from scaffolds swung from deck beams or other overhead supports by means of ropes or chains; and many of the hazards incident to labor on the outside staging are also present in connection with the interior work. Moreover, the interior work must often be done from extremely awkward positions, and where there is a temptation to undertake work alittle beyond the safe reaching point. The attempt to reach too far is a common cause of the falling of ladders, and of workmen losing their balance. Ladders from which work is to be done should invariable be lashed, or otherwise securely fastened, both at the top and at the bottom. Even though considerable delay is involved, stagings and ladders should be adjusted to the convenience of the workman, if accidents from over-reaching are to be avoided.

Strict Supervision Required

In view of the vast amount of work that must be done from shipyard stagings, strict supervision should be exercised over the construction and maintenance of all structures of this kind. A busy yard can ill afford to dispense with the services of a capable staging supervisor and his gang of workmen. It is certain, for example, that a competent supervisor would not permit a doubledecked staging to be used, without adequate overhead protection to the men on the lower level; yet scaffolds of this kind, without any protection whatever, are very commonly seen in shipyards.

In building a ship there is a certain point at which the accident rate is likely to reach a "peak," and experience shows that this occurs when the framework or ribs of the vessel are being placed. The ship is then a mere skeleton, and the men have to perform arduous work with very insecure footing. During stormy weather they are likely to lose their balance from gusts of wind, or beams or plates that are being swung into position are likely to be suddenly swerved by the wind, at great peril to the men. There does not seem to be any way to provide satisfactory safeguards in connection with this part of the work. Only the most skilful and careful men should be employed at it, and they should be set at other tasks whenever the weather conditions add materially to the hazard.

FIG. 5: RIVETERS WORKING FROM A SUSPENDED STAGING. THE RIVET HEATING FORGE AT THE LEFT IS TOO FAR FROM THE RIVETERS FOR SAFETY OR EFFICIENCY.

Another hard problem to deal with is the elimination of cuts and bruises and other minor injuries, which are very numerous in the aggregate. Cuts due to handling steel plates with sharp or ragged edges, and finger bruises and lacerations from hammer blows, or from punching or shearing machines, are especially common. It cannot be said that the employment of none but skilled labor constitutes a remedy, for in the main the work that produces these injuries is already in the hands of skilled workmen. The only solution appears to be, to stimulate the men in every way possible, to exercise personal caution.

Hoisting Equipment Risks

Derricks, gantry cranes, and overhead railways are employed to hoist girders, machinery, and other heavy parts, and to transport them to various sections of the ship. During certain stages of shipbuilding, specially skilful handling of the crane and derrick loads is necessary if serious accidents are to be avoided. The men on the skeleton of the ship have a precarious footing at best, so that poor judgment, or a misunderstanding of signals, when lowering or swinging a load, may either cause a workman to be thrown down from his position, or cause him to miss his footing in his quick endeavor to escape. Here, again, is an illustration of the need of providing a competent safety man to actively supervise all operations of a dangerous character.

Unprotected Openings

So far, we have dwelt mainly on accidents due to falls from staging, ladders, and other elevated structures. One other

source of falls must also be prominently mentioned. It would be hard to name an industry in which there are more opportunities than shipbuilding affords, for falling into unprotected openings. In the modern vessel with several decks there are many openings for ventilators, bunker hatches, and other permanent uses, in addition to those that are left for temporary building purposes. Unless these various openings are covered over whenever they are not actually in use, workmen and others who may have occasion to go near them are in danger. Stout wooden covers, with the edges on the upper side beveled, are excellent safeguards, and when they must be left off to admit light and air, strong wire-mesh guards may be used instead of solid wooden ones. As workmen are prone to remove covers of this kind, and leave them off, it should be the duty of some one specified man to see that a sufficient number of proper covers are provided, and that they are kept in place.

The influence of poor illumination on the accident rate in shipbuilding has been very marked in the past, but there is evidence that lighting conditions are being rapidly improved. Formerly a ship under construction, having no self-contained lighting plant, usually depended on gasoline torches or oil lamps; and this condition still exists in many sailing vessels and in some steamships. Explosions and fires, with resultant burns, were frequent occurrences. In addition, parts of the ship that were not much frequented were left in total darkness, while other parts were not lighted well enough to permit a maximum of efficiency and safety in the work. Of late years, the extension of lines for the transmission of electrical energy, and the installation of power-houses at the shipyards themselves, have made available a very flexible source of power and light. It is a simple matter to string wires to any part of the ship and to use the particular size and type of lighting-unit best suited for the space to be illuminated. Particular attention should be given to the lighting of the approaches to the ship, where large-sized lighting-units, suspended well above the ground, are desirable.

FIG. 6. WELL CONSTRUCTED MAIN APPROACH, WHICH IS A PERMANENT STRUCTURE, GIVING DIRECT ACCESS TO THE UPPER DECK OF A SHIP ON THE STOCKS.

Passing Hot Rivets

Each year shows a number of serious and fatal accidents to boys of from fifteen to eighteen years of age. While serving their apprenticeships the boys are at first employed as rivet-heaters, rivet-catchers, and markers, and in performing work of this nature they are often stationed at high elevations and in dangerous and exposed parts of the ship. The boy who heats the rivets throws them to another at some distance, who catches them in a keg or bucket and quickly places them in the holes for the riveter to drive. Speed is essential in order that the rivets may be as hot as possible when they reach the holes. It is evident that the ability of the rivet-heater to throw the rivet accurately has an important bearing on the safety of the rivet-catcher as well as upon that of other employees at work below. If the rivet-heater's aim is poor, the catcher must either reach out at the risk of losing his balance, or else allow the rivet to pass on with the chance of striking someone below. None except mature men should be assigned to this work; and those at work directly beneath the rivet-catcher should be protected by hanging a substantial, close-meshed wire-netting under the working area, and moving this netting as the work progresses.

Accidents From Falling Objects

Accidents from falling objects are of frequent occurrence in shipbuilding. Planks, bolts, hammers, wrenches, driftpins, and various other tools and materials, are often displaced or accidentally dropped by workmen, and the vibration resulting from the incessant hammering and riveting also contributes to the general downfall, to the constant peril of workmen stationed below. Accidents of this nature can be greatly reduced by strapping or bolting the platform planks of the staging, as already recommended, and by providing all staging platforms and all shelves and other storage places with effective toe-boards or side-boards. Substantial overhead shields should be erected for the protection of all men who are stationed where they might be injured by the fall of objects from work-places at a higher level, and like protection should be erected over all passageways or gangways where a similar hazard exists. The spaces between the staging platforms and the hull of the ship should also be bridged over, as far as practicable, with wire-mesh guards supported on pins thrust through holes in the bearer-bars of the staging, or in some other effective way. These can be made in sections, and used over and over.

Approach Gangways and Runways

The main gangways or runways, leading from the ground to the interior of the ship or to the staging platforms, should be well constructed and of ample proportions. They should be properly railed, and provided with suitable landings at the top. When ever there is any likelihood of material falling from them, they should also have toe-boards at both edges. A ramp or runway having a gradual rise, and provided with substantial hand-rails on each side and with cleats to prevent slipping, increases the efficiency and the safety of the men. It seems hardly necessary to point out the importance of promptly removing ice and snow from all runways and platforms, and from all parts of the ship. Further protection should be provided by the liberal application of sand or ashes.

When the staging is dismantled, the various parts of it should be lowered to the ground by means of ropes, instead of being thrown down. If the material is thrown down there is always the chance of some one inadvertently getting in the way of a falling plank, or some one at a supposedly safe distance being hit by pieces that take unusual rebounds. With careful lowering, the timber is also far less likely to be broken or otherwise damaged.

Some shipyards do overhauling and repairing, as well as new work; and although the hazards in yards of this kind are similar, in the main, to those that exist in yards that do construction work only, there may be certain minor differences. A ship is not earning dividends while she is in the repair dock, and for that reason her owners usually insist that she be placed in commission again at the earliest date possible. This means that the repair men must plan in every way to save time, and a limitation of this kind often introduces new dangers.

Paint Work Hazards

For example, painting the interior of the ship with standard, oil-mixed paints necessitates considerable delay for drying, both between coats and after the finish has been applied; and in order to eliminate this delay it is customary to use quick-drying paints, containing highly inflammable substances, such as benzine, benzol, or alcohol. Paints of this nature hasten the work, without doubt; but the use of them is attended by the risk of explosions and fires, and they may also produce injurious effects on the workmen. When paints containing volatile constituents that are inflammable or toxic are used in confined places

no open lights should be permitted, and smoking or the use of matches for any purpose whatever should never be allowed, on pain of immediate dismissal. The men should also have frequent periods of rest in the open air, and foremen should inspect all confined workplaces at least once every half hour, while the work is going on.

Good ventilation is highly important wherever paints such as we have described are being used, and if the quarters in which the men have to work cannot be ventilated easily and effectively by natural draft or by fans, a plentiful supply of fresh air should be introduced by means of a centrifugal pump and one or more lines of large canvas hose. The air should be delivered, in such cases, at the innermost part of the space, so that the objectionable vapors will be removed as thoroughly as possible. If the work is being done in a pit-like or well-like space, each workman should also wear a belt with a stout life-line running up to the entrance to the workplace, and **two** men should be stationed above, to draw the workmen up to safety in case they become overpowered, or show signs of drowsiness or of unnatural exhilaration. In some cases it will also be advisable to provide the workmen with special respirators, supplied with fresh air by a pump.

First Aid Installation

In view of the large number of minor injuries about a shipbuilding plant, it is highly important to provide a first-aid room, or a hospital. Bruises, slivers, and cuts are not necessarily dangerous if they receive proper attention at once, but the average man will seldom quit work in order to attend to a slight injury, unless he can be treated immediately, so that he can return to his work without much delay. Even though he knows of hundreds of cases of blood poisoning due to the neglect of seemingly insignificant wounds, he will "take a chance" rather than go to his home, or to the office of his family physician, for the treatment of a minor injury; but he can have no logical objection to receiving proper treatment by a competent person at the yard. The facilities at hand should be sufficient to render first-aid in the case of serious injuries also, because proper treatment of this kind has a large influence on the ultimate recovery of a badly-injured man. It is important, however, to see that all first-aid work is done by a fully qualified person. Otherwise a great deal of harm may result.

In the shipbuilding industry there are quite a number of cases of lead poisoning every year. The exposure is usually incurred while sandpapering painted surfaces or removing old lead waste (sometimes in confined spaces such as tanks, or between double bottoms or in bilges), or from breathing the fumes that are produced when red-hot rivets are placed in holes lined with red lead. Exhaust ventilating systems and a sparing use of lead paints tend to reduce this hazard.

Educational safety work is specially important in the shipbuilding industry which is admittedly a dangerous one. Moreover, the operations that must be performed are of such a nature that it is hard to provide mechanical safeguards that will afford a protection comparable with that which may be had in many other similarly hazardous employments. Hence it is doubly important to study and promote safe methods of doing the work, and to instil the principle of personal caution into every employee about the yard. If the men can be brought to look at the safety question from the right point of view, and good "team work" can be secured, the accident rate will certainly fall off to a remarkable extent.

ORIGIN OF TONNAGE MEASUREMENT SYSTEMS

THE present system of tonnage measurement, known as the Moorsom system, became law in 1854, and, though subsequently amended in detail, remains to this day the basis for the computation of tonnage in all the principal nations of the world.

According to Sir George Holmes, who is quoted by *Syren and Shipping* in the matter, an Act was passed in 1694 for measuring the tonnage of English merchant ships which contained the following rule:

$$\text{Tonnage} = \frac{L \times B \times D}{94}$$

When L = length of keel (so much as she treads on the ground).
B = breadth amidships from plank to plank, in board.
D = depth of hold, as before.

This formula was supposed to give the deadweight carrying capacity of the vessel. The product $L \times B \times D$ expressed, of course, the parallelopipedon of which the sides were the length of keel, the breadth in-board from plank to plank, and the depth of hold, and the divisor 94 meant that every 94 cub. ft. of this parallelopipedon was to be reckoned as one ton. As the true internal volume of the vessel would not exceed six-tenths of that of the parallelopipedon, it is evident that about $(94 \times 6) \div 10 = 56.4$ cub. ft. was reckoned as a ton, and this figure approximated fairly to the value in the time of Henry V. An Injurious Act. The Act of 1694 was repeated two years later, and in 1720 another was passed which substituted the half-breadth for the depth of hold. Probably no Act has ever done more injury to naval architecture than the tonnage law of 1720. The half-breadth no doubht represented at the time very approximately the depth of hold; but the law offered a direct inducement to shipbuilders to augment the carrying power of their vessels, without altering the legal tonnage, by the simple expedient of increasing the depth while making no corresponding increase in the breadth, and thus a class of short, narrow, deep and utterly unseaworthy vessels came in existence.

The celebrated Tonnage Act of 1773, which remained in legal force for 62 years, and was still in use in the Royal Navy till as lately as 1872, perpetuated, Sir George goes on to say, the same error. The tonnage, as measured under this Act, was called "Builders' Old Measurement Tonnage." The length for tonnage was measured along the rabbet of the keel, from the back of the sternpost to a perpendicular dropped from the fore part of the main stem under the bowsprit. From the length thus obtained, a deduction equal to three-fifths of the breadth (measured as explained farther on) was allowed, and the difference was called the length for tonnage. If the vessel were afloat at the time of measurement, instead of taking the length along the keel, the length of waterline, or of deck was ascertained, and an allowance made by way of reduction of 3 in. for every foot of draught. This allowance was to compensate for the rake of the sternpost, and was independent of the deduction of three-fifths of the breadth.

The breadth was measured outside the planking at the widest part of the ship, but the thickness of any doubling strakes was not included. Half of this breadth was taken instead of the depth. Subject to these allowances and differences in the mode of measurement the B.O.M. tonnage law was identical with that of 1720, the devisor 94 having still been used.

Later Development

Between 1836 and 1854, what is known as the "New Measurement" system was in force. The object of it was to obtain a more accurate computation of the cubic contents of those parts of a vessel available for stowage, underneath the permanent decks. The depth was restored as an element in the calculation, but the various lengths, depths and beams were to be measured at *a very few fixed positions*, and this peculiarity of the Act offered owners many opportunities of evading the intention of the law. It is said that in some cases ships built under this Act had a volume of about one-sixth greater than their nominal capacity. The factor of division was 92.4 instead of 94, and in the case of steamships the volume of the space between the engine-room bulkheads was allowed as a deduction from the gross tonnage. The general effect of the Act was to do away with the premium which previous legislation had offered to the building of short, narrow, deep ships; but on account of the many opportunities which it offered for evasion, it was eventually superseded by the Moorsom system of measurement.

Irrelevant Remark Defined.—She was a pretty girl, quite the belle of the class, and the cause of many a heart flutter. The teacher asked her one day if she could define an irrevelant remark.

"I can't just define it," she answered, "but I can give you an example."

"Well give us an example, please."

"Well, if I was going through a dark hall and met Billy Peterkins and he should ask me the time and I should say, "my your nose is cold," that would be an irrelevant remark.

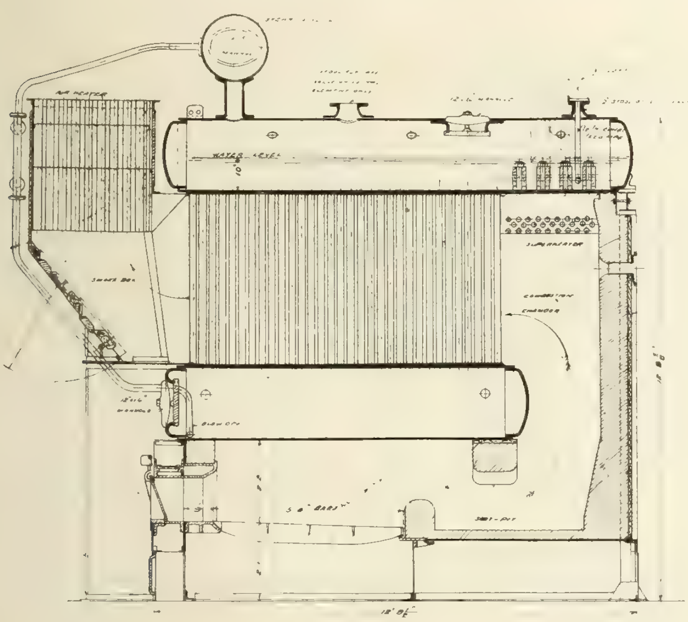
The "Howden" Sectional Type, Water-Tube Steam Boiler

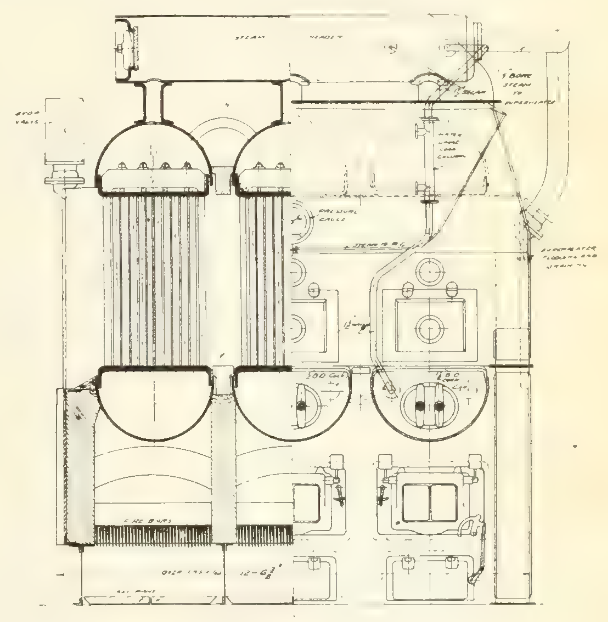
By C. T. D.

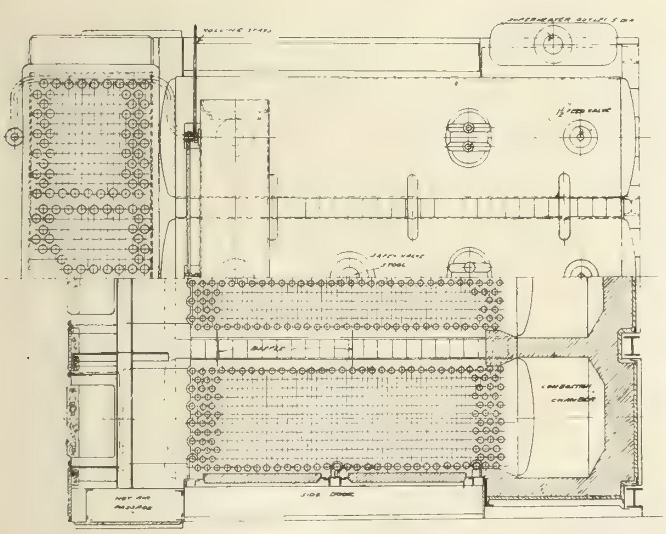
With the development of an intensive shipbuilding and marine engineering activity, there has resulted both a tendency and necessity to deviate from the beaten path in the matter of design and constructional detail of a number of the prime essentials entering into one or other, or both of the twin industries. The accompanying article features a type of water-tube boiler now being made in Canada, suitable for either land or marine installation, but which has hitherto figured but little, if any, as a factor in her steam engineering practice.

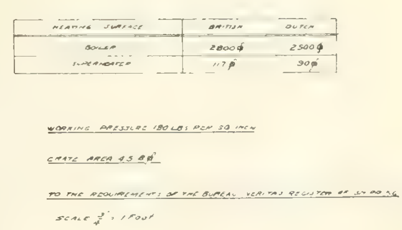
THE "Howden" boiler as we find it to-day is a development of one designed in January 1861 by the late James Howden, of "forced draught" fame, and who in his lifetime was chairman of both James Howden & Co., marine machinery builders, and of the Howden Boiler Co., Govan, Scotland. As the date when the first Howden boiler was constructed occurred at a stage of marine engineering during which the use of high pressure steam for marine purposes took a sudden leap upwards, anticipating a progress which was not generally reached until fully 20 years thereafter, it will doubtless be interesting after an interval of some 56 years to chronicle the circumstances which initiated and led up to the present design.

In 1861, the usual steam pressures for marine boilers were from 20 to 25 pounds per sq. inch, beyond which it was not considered safe to operate with a salt water feed supply. Shortly before this period, however, several attempts had been made to introduce steam pressures of 100 pounds per sq. inch into steamships with compound surface condensing engines. Among these pioneers of the use of high pressure steam through compound engines and the use of fresh feed water, was the chairman of the Howden Boiler Co., who in 1859 contracted with the "Anchor Line" Steamship Co., to equip one of their Mediterranean fruit steamers with his then recently patented compound surface condensing engines and boilers to work with steam at 100 pounds per sq. inch. This steamer built by Alexr. Stephen & Sons, on the upper reaches of the Clyde, began to run in 1860, being successful and economical, running voyage after voyage without requiring overhaul or repair. Her boiler was as far as known, the first high pressure steam generator to operate successfully at sea in ordinary traffic continuously for a considerable period.





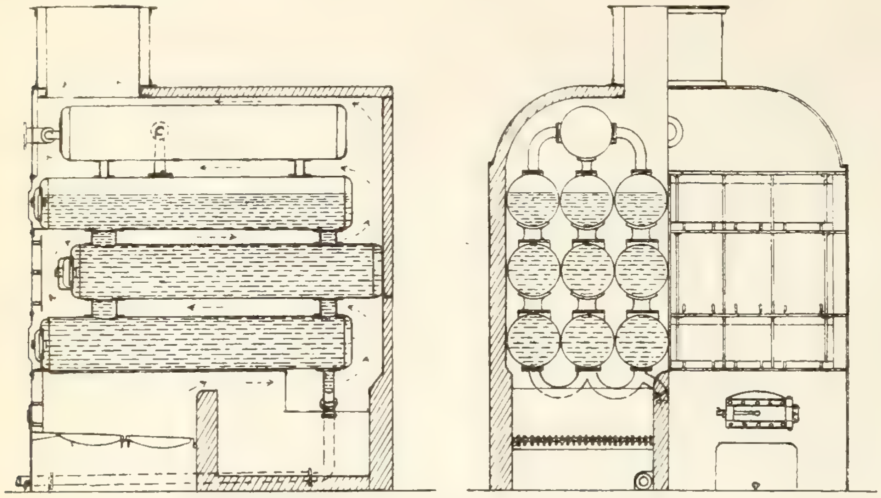




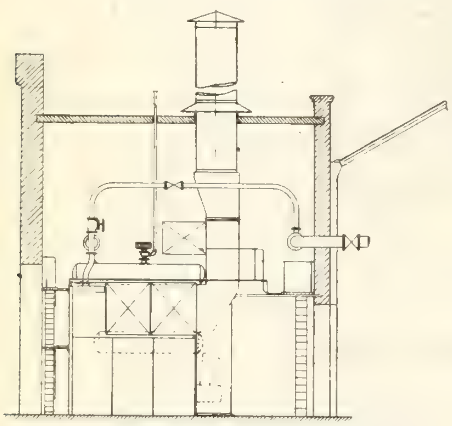
THREE ELEMENT "HOWDEN" MARINE TYPE WATER TUBE BOILER NOW BEING MADE IN CANADA.

Another screw steamer ordered about

the same time by J. H. P. Hutchison for their trade between Glasgow and Bordeaux, and built by James R. Napier, F. R. S., at Govan, had compound surface condensing engines, also boilers using 100 pounds per sq. inch steam pressure, installed. Owing to the then design of the boiler, however, and the effect of salt water from a leaky surface condenser, this vessel never accomplished a voyage to Bordeaux and back without being laid up on account of the boiler requiring overhaul and repair. Inaccessibility for cleaning and repair were drawbacks to the boilers and, with a view to giving greater convenience in these respects, a new design was developed and gave satisfactory operating results, notwithstanding the fact that leaky surface condensers were responsible for abnormal incrustation of salt on the interior boiler surfaces. The accessibility procured limited materially the heating surface, hence rapid combustion, which progress in steamship engineering necessarily entailed, was more or less negatived. The subsequent evolution of the cylindrical multitubular boiler (Scotch), with its simpler style, and greater heating surface in same space occupied, evidenced a more economical design, and being, in addition, better fitted for the marine service of that period, naturally took pride of place, and still maintains a strangle hold.

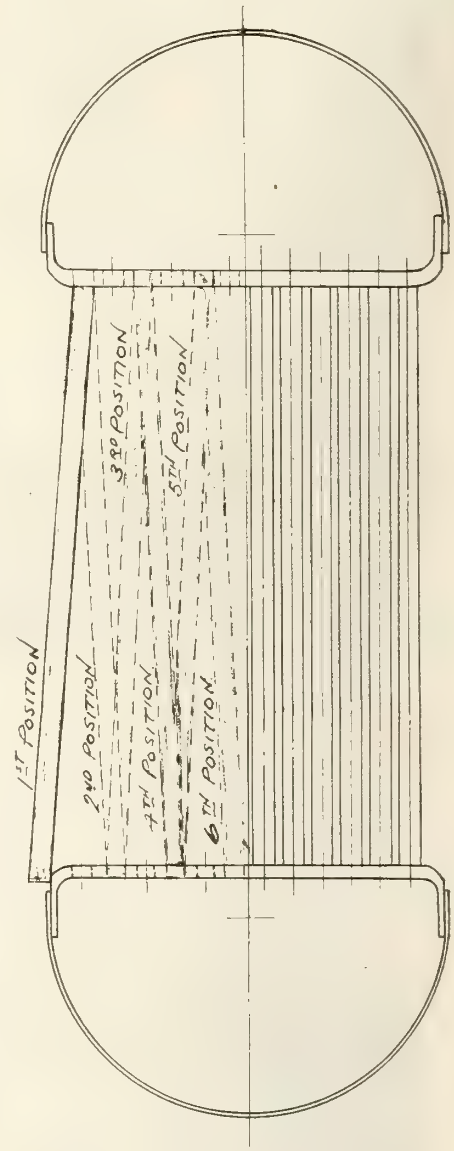


ORIGINAL DESIGN OF "HOWDEN" BOILER, JANUARY, 1861



SIDE ELEVATION OF "HOWDEN" BOILER INSTALLATION AT BOROUGH OF BERMONDSEY ELECTRIC LIGHT STATION

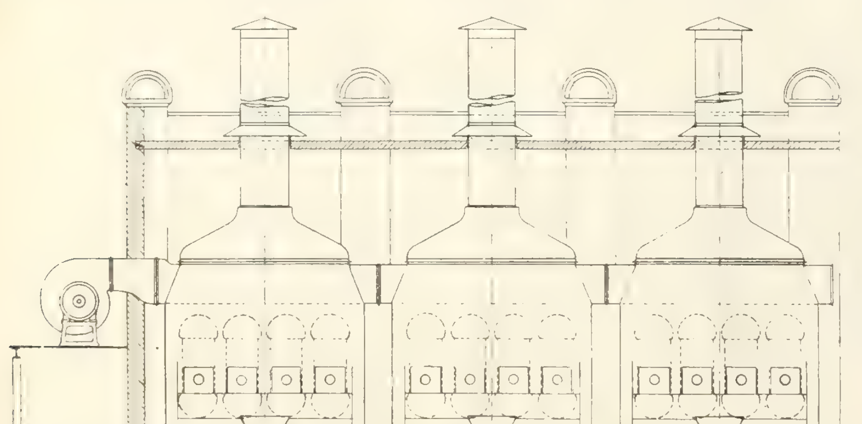
The present Howden boiler combines an evaporation from plate surfaces, as in ordinary boilers, with the addition of that from water tubes. It is now constructed under at least three patents—1908, 1910 and 1912, respectively, the last mentioned including a design specially adapted for high speed steam vessels, where lightness and small space occupied are of vital importance, or, for use on land in places difficult of access where the several parts can be carried by men or animals and put together without skilled labor under the direction of one competent engineer. All Howden boilers are designed to be equally suitable for land or marine services. As will be noted from the illustrations, covering boilers now being built by the Polson Iron Works, Toronto, who are the licensees for Canada, the individual units are simple in character, there being the minimum of detail parts,



METHOD OF STEPPING-IN NEW TUBES

The worst possible position for a leaky tube is indicated. The intervening tubes are of course cut out and the new one threaded into position as shown. In consequence the holes are slightly larger in diameter than they were originally after expanding. This slackness allows the tubes to to be stepped into the various positions. The inner tubes require renewing at rare intervals.

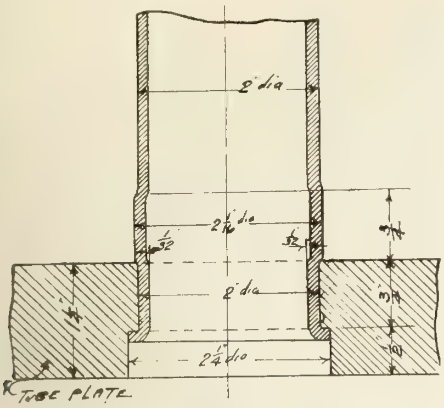
while the sections or elements are duplicates of each other. One boiler may consist of one, two, three, four, or more elements, all the details of which lend themselves to repetition and duplicate work, therefore all parts can be made by special machinery to standard gauges, ensuring accuracy of duplication and good workmanship. The Howden boiler is adapted to work safely and economically under the highest air pres-



FRONT ELEVATION OF "HOWDEN" BOILER INSTALLATION AT BOROUGH OF BERMONDSEY ELECTRIC LIGHT STATION

sure of the Howden system of forced draught, and at the highest steam pressures now employed.

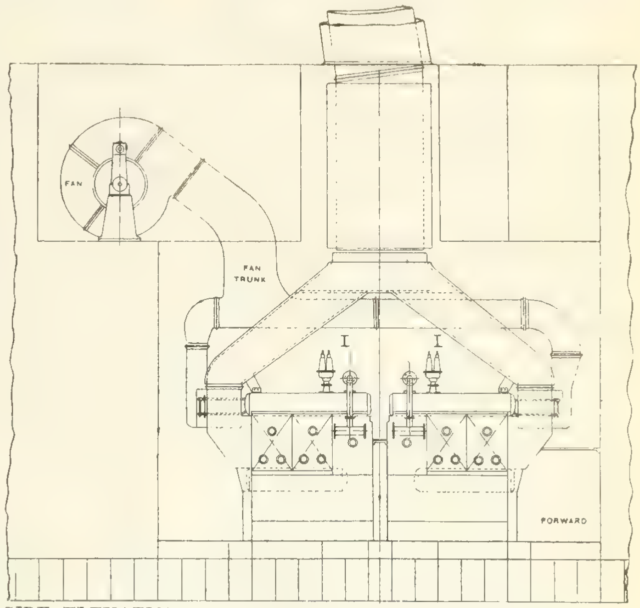
All parts of the boiler when working are under an equal heat, that is, no one



DETAIL OF TUBE FASTENING IN TUBE PLATES

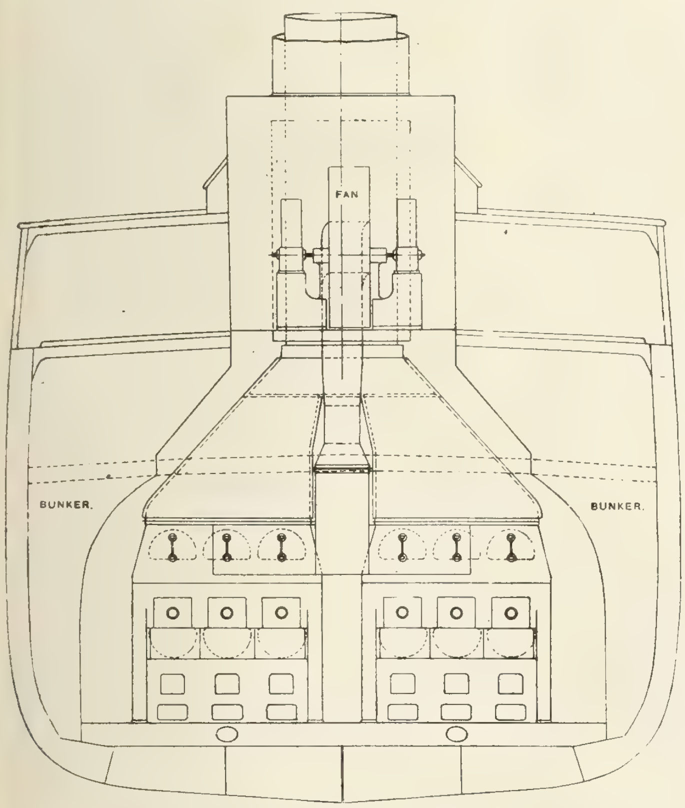
Tubes cutter and extractor should be used for withdrawing tubes when possible, but if hand chisel be used, great care must be taken so as not to injure tube plates.

place is hotter or colder than another, while, in raising steam from cold water, all parts are brought under heat at the same time. The design lends itself to a rapid positive natural circulation without piping or other adjuncts, also to internal self-cleansing in the water tubes and drums where the water is in continual rapid movement over the surfaces exposed to the hot fire gases. In the matter of accessibility, attention is called to the fact that in a four element boiler, by the removal of eight manhole doors, the whole of the internal working parts of the boiler, that is, top and bottom drums and tubes, are at once open for examination when necessary. The fact that the tubes are short and straight is a matter of much importance, as they can all be examined in each element in a few minutes. For outside examination, the side portable doors can be quickly opened or removed, also the smokebox doors; and further, the combustion chambers are accessible by manholes from their underside, from which the back and tubes can be examined. Tubes can be removed and replaced quickly, the method of doing so being illustrated, as also the scheme of their fixing in the drum tubeplates.



SIDE ELEVATION OF "HOWDEN" BOILER INSTALLATION ON BOARD SHIP.

In the fitting of Howden boilers into steamships, important savings are effected. Vessels which are to have cylindrical boilers installed cannot be finished completely at the yard in which they are built, as marked spaces in decks and upper works above the boiler rooms must be kept open, not only for purpose of lowering heavy cylindrical units into place by crane after launching, but the work must be finished in such a way after the boilers are on board that these decks and upper works may be opened up again to remove the boilers when they are worn out or damaged, which always takes place after a longer or shorter period of service, and in order to refit the vessel with new boilers. In large high power steamships, the cost of opening up and reclosing deck work, etc., together with that for crane service, amounts to a large sum. In the case of the Howden boiler, the several parts can be put on board by either the shipyard derricks or those of the vessel herself, being afterwards lowered to place for erection, through the stokehold hatchways or the funnel opening.



FRONT ELEVATION OF "HOWDEN" BOILER INSTALLATION ON BOARD SHIP.

The Howden boil- may be equipped with chain grates or other mechanical stokers for land installations and may be operated under either forced or natural draft, although necessarily only with the former can the highest economy and power be obtained. The boiler patents include a superheater of simple and efficient design integral with the structure of each generating unit, also a feed heater or water back forming part of the boiler evaporative surface, which is specially suitable for naval installations where reduction of weight and increase of tube surface and power in a given space are of material importance. When superheated steam is not required, the superheater can be immediately converted into ordinary heating surface, and thereby increase further the evaporative capacity of the boiler. From the illustrations accompanying, no difficulty will be experienced in grasping the detail features which go to make up either individual or combination units.

Test of No. 1 "Howden" Boiler

Heating Surface	3,125 sq. ft.
Grate Area	54 sq. ft.
Duration of Test	6 hours
Coal Burned (Bituminous Scotch)	11,058 lbs.
Coal Burned per Hour (average)	1,803 lbs.
Coal Burned per sq. ft. Grate	34.1 lbs.
Total Ash and Clinker	1,120 lbs.
Ratio of Ash and Clinker to Coal Fired	10 %
Total Water Evaporated	107,100 lbs.
Water Evaporated per Hour (average)	17,850 lbs.
Water Evaporated per lb. of Coal as fired under 192 lbs. pressure	9.68 lbs.
Water Evaporated per lb. of Coal as fired from and at 212 degs. Fah.	11.38 lbs.
Water Evaporated per lb. of Combustible at 192 lbs. pressure above atmosphere	10.7 lbs.
Water Evaporated per lb. of Combustible from and at 212 degs. Fah.	12.58 lbs.

Steam Pressure ...192 lbs. per sq. in.
Feed Temperature entering Boiler (Water Heated with Live Steam from Boiler).. 97 degs. Fah.
Temperature of Water in Feed Tanks .... 59 degs. Fah.
Funnel Gas Temperature ....473 degs. Fah.
Temperature of Gases Entering Air Heater 545 degs. Fah.
Temperature of Air in Reservoir ....196 degs. Fah.
Atmospheric Temperature at Fan .... 72 degr. Fah.
Air Pressure at Fan ....2⅝ inches
Air Pressure in Ashpit ....1¼ inches
Air Pressure in Furnaces .... ½ inch
Moisture in Steam (by Barrus Calorimeter.....About 1%
Flue Gas Analysis, CO_2 ....14.8 %
Flue Gas Analysis, C.O. ...... Nil.
Flue Gas Analysis O. 4%

Funnel 3 ft.-8 in. in diameter, 34 ft. in height above uptake, and 50 ft. above fire grate.

Steam was disposed of during the trial by blowing off into the atmosphere. Ashes were cleaned from ashpit forty minutes preceding the start of the test, and all observable clinker removed at that time. The fires burned freely, very little smoke being observed, and that only when firing.

Three Element Boiler Detail

The illustrations on the first page of this article show the three element Howden boiler, several of which are being constructed at the Polson Iron Works Toronto, for wooden freighters being built in various yards in Canada. Although the principal features have already been summarised, a few particulars regarding the general construction will be of interest. The boiler is made up of three elements having a total heating surface of 2800 sq. ft., while the superheater has 117 sq. ft. of heating surface. The grate area for .75 in. forced draught is 45.8 sq. ft., the fire bars being 5 ft. long. The evaporation per hour from feed at 120 degs. Fah., is 13.750 lbs., thus the boiler as shown in the illustration referred to above, will give a total evaporation of 13.750 lbs. per hour from combined heat absorbing surface of 2800 sq. ft. and 45.8 sq. ft., .75 in. forced draught grate area, with coal of not less than 12,000 b.t.u. per lb.

The boiler is supported in steel framework in such a manner as to allow free expansion. The units are encased with brick and have doors at the side for getting at the tubes for cleaning or renewing. The feed and blow off enter the lower drum at the front head into an arrangement of internal pipes. Provision is made in combustion chamber and smoke box door for removing soot from the tubes belonging to the boiler and air heater. The forced draught is of "Howden" latest and improved type, as are also the fire doors which, when opened, automatically shut off the draught. The space occupied by the boiler including brickwork is as follows:—Width, 12 ft. 6⅜ in.; depth 12 ft. 8 ins.; and height 12 ft. 9 ins. The boilers are tested by water pressure to 360 lbs. per sq. inch, for the working pressure of 180 lbs. per sq. inch.

FITTING A SPARE PROPELLER SHAFT AT SEA

THE breaking of a propeller shaft and the necessary repair or replacement from spare while afloat is ever a job involving considerable resourcefulness and determination, even under the most favorable conditions, but when exceptional circumstances have to be reckoned with, it requires uphill work and pluck to carry it through. A case brought to our notice. says the *Marine Engineer and Naval Architect*, besides being of much interest, reflects great credit on the engineers, as it comes under the category of work carried to a successful issue under adverse conditions.

The "Pukaki," a steamer occupied in coastal trading in Australasian waters, left Nauru for the Caroline Islands with Kanaka passengers, calling during the course of the run at twenty-six islands, many of the calling places having neither berthing accommodation nor anchorage ground, thus involving constant attention to the engines, moving ahead and astern to keep off the reefs and rocks. Fortunately the sea was calm, only disturbed by rain squalls. All went well until nearing the terminal port of call, Kussie, when a shaft broke, the engines being at once stopped and the fires checked. On investigation it was found that it was the propeller shaft which had parted in the stern tube, the propeller being up against the rudder post, and to save it from loss or injury it was secured by slings.

Examination showed the stern tube to be intact and the breakage to be near the fore end of the after liner, so that the idea of cutting the tube and connecting the broken ends of the shaft by the patent Thomson's coupling had to be discarded. Gear was rigged and the forward end of the shaft drawn into the tunnel, the gland, being about 4 ft. below the water line, had to be made watertight. Meantime sails had been rigged up to keep the ship steady and a boat was despatched to Kussie, so that official notice might be sent to Melbourne. Arrangements were then made to tip the ship. About 120 tons of coal were shifted from No. 4 to No. 1 by extemporized appliances, and the deep tank and fore peak were pumped up; Nos. 1 and 2 holds were filled up to the ceiling only, as there was no bulkhead between them and to have loose water with the sea swell on would add to the rolling and not be conducive to the work before the engineers.

The stern tube was still under water, in spite of which gear and tackle were prepared and the propeller slung; stopper and nut were removed, the boss was then turned round to get the key on top and the end of the shaft set up against the rudder post. The anchor stock was requisitioned for ramming off the propeller, angle irons and wedges being fitted at the fore end of the boss, between it and the stern tube to assist the ram. It was difficult to get a fair blow with the anchor stock, two blade nuts and a stud being damaged in the process. The broken shaft was got on deck, tackle rigged on the derrick aft, by means of which it was slung over the side and brought to bear on the boss; part of the flange broke with the impact, but reward crowned renewed efforts, and the propeller was displaced amid the cheers of the onlooking passengers, who by this time were, with all hands, on short rations. The outer broken end had now to be got into the tunnel and this was no easy matter. Hauling-in gear was fixed up and connected to the winch, and the shaft end was pulled in so far and stuck; on being pushed back and the tube examined, it was found that a loose broken piece of the shaft had caused the obstruction and on its removal the captured end into the tunnel was effected.

A new difficulty and a great disappointment to the chief engineer now presented itself, in that the spare shaft was found to be too large in the tapered end by from 1-3 forward to ⅝ in. aft, the keyways were uncut and no keys ready. By means of chisel bars and cross cuts the taper was made right to templets and filed up, keyways cut and keys forged from an old valve spindle. Negotiations were at about this stage opened with a steamer brought within hailing distance by signals, while the work of repair was under way, as provisions were getting scarce; however, the proposed rate for towage was deemed too high, and they were not running any dangerous risk, save as to food, which was supplemented by some bags of rice and flour from the hailed steamer before she left them to their own resources.

The spare shaft was now run through the tube, the propeller shipped on and the nut screwed up, then hammered home. As the boss and taper could not be tested from markings, but simply taken to be a fit from the templets, provision was made on the nut by means of an eyebolt screwed into it for lashing it firmly to the propeller to keep it from shifting, should the stopper not be got into position due to the inadequate means of obtaining a perfect fit; the eyebolt was not required—a certificate to the engineers for accurate workmanship. The shaft was coupled up, and as the bolt holes were small, involving a good deal of time and labor in boring and reaming, this was dispensed with and temporary bolts were prepared and fitted into the aft propeller shaft, the larger holes in the tunnel shaft coupling being made up with wedge pieces around the bolts.

The holds and tank were next pumped out, steam raised and the Pukaki steamed off to her port of destination, Rabaul, at the rate of 7 knots on March 11th. As the passengers and crew numbered 297, the lengthened period tried severely the efforts of the culinary department to feed all hands, and during the last week or two there was no bread, except a biscuit, at meal times to sustain the hard workers, and there was no more than sufficient rice for the Pukaki's crew.

The "Alquist" Transmission Gearing for Ship Propulsion*

By W. L. R. Emmet **

The feature of the Alquist gear that renders it specially suitable for the transmission of large amounts of power is its flexibility, which permits it to yield at points under excessive pressure. This flexibility is secured by building the gear of plates between which there is a small clearance, this clearance allowing a slight lateral movement of the periphery which relieves the stress on the helical teeth. Some results secured in ship propulsion are appended.

THE designs described in this paper are based upon the inventions of Karl Alquist, an accomplished engineer formerly connected with the Turbine Department of the English branch of the General Electric Co—the British Thomson-Houston Co. His gear inventions were first brought to the attention of the writer early in the year 1911. For some time previous Mr. Alquist had en-

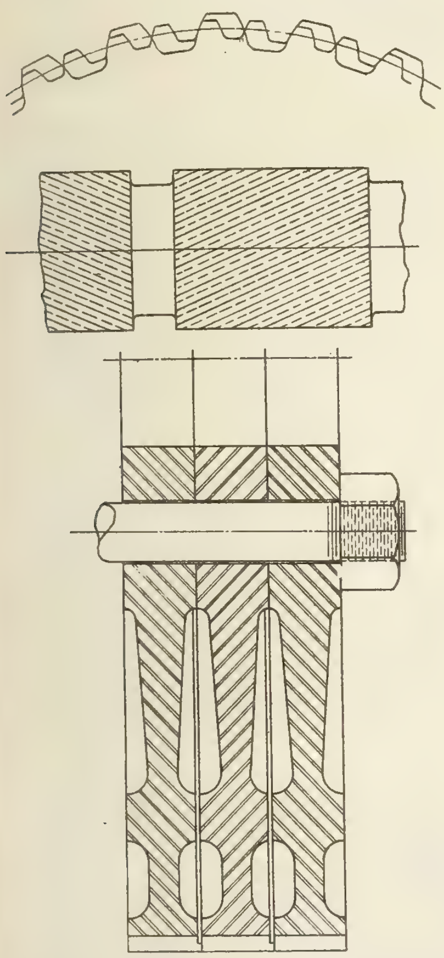


FIG. 1. CONSTRUCTION OF "ALQUIST" FLEXIBLE REDUCTION GEAR.

deavored to arouse interest in his methods in England and on the Continent but had accomplished nothing. At that time the General Electric Co. had not begun the commercial manufacture of high-speed spiral gears, but had for some time been conducting experiments to determine the limits of speed, pressure, etc., which were practicable with such gearing. The importance of high-speed gearing in connection with turbine and electrical applications is obvious and the General Electric Co. was working with a view to a development of the best standards to adopt.

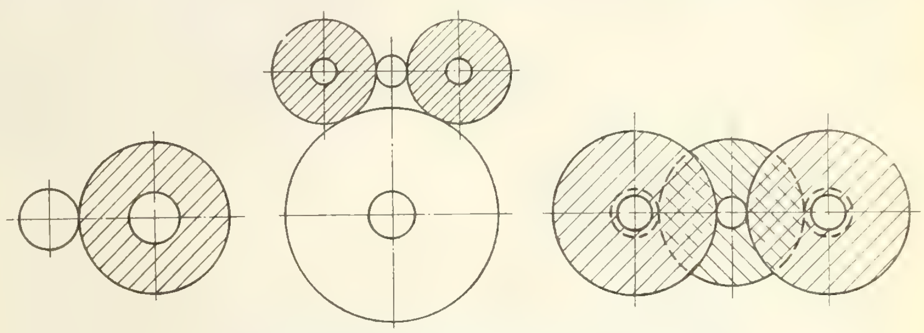


FIG. 2. VARIOUS ARRANGEMENTS OF PINIONS AND GEARS.

Certain features of Mr. Alquist's proposals appealed strongly to the writer, and arrangements were made with Mr. Alquist to come to America and assist in experimental developments along the line of his inventions.

The result of this undertaking has been that many sets of gearing have been built and experimented with exhaustively under a variety of conditions, and by these experiments certain standards of practicability have been established and extensive commercial developments have been undertaken. Gearing of this character has been applied to about seventy-two sets where steam turbines drive electric generators of various types. Contracts have been closed for machinery for the propulsion of seventy ships aggregating 215,200 horse power. Some of these electric generating sets have been in service one and one-half years and about seven of the ship sets are in service, some of them having made many long voyages. Among these are high-pressure cruising units for the battleship "Nevada" which have been in service for some time and shown very fine results. Among the ship equipments not yet completed are included the propelling machinery for Destroyer No. 69, built at Mare Island, and new propelling machinery for the scout cruiser "Salem." In all of this practical

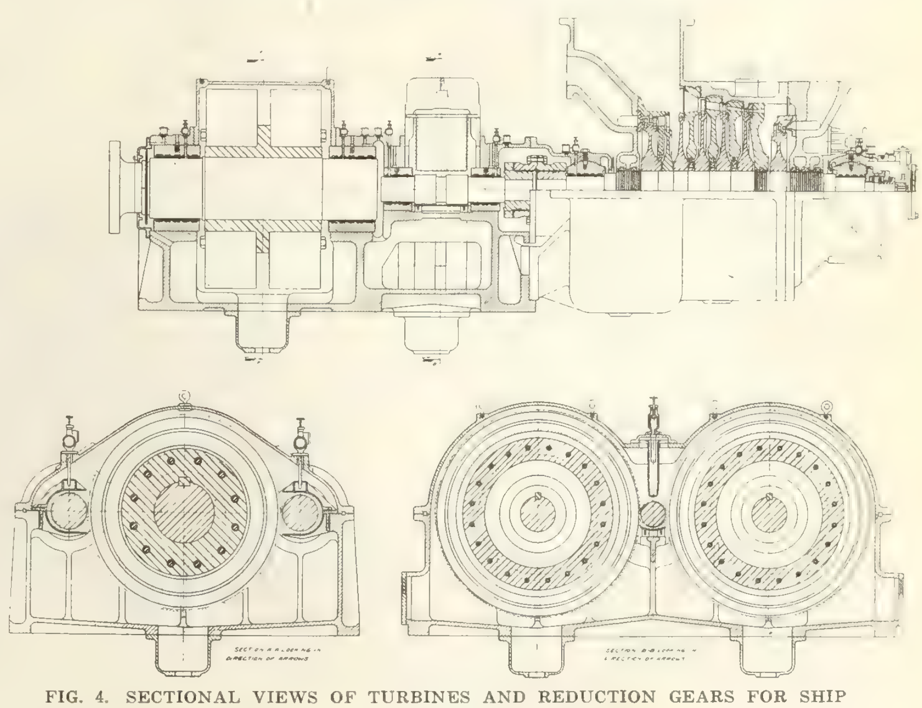


FIG. 4. SECTIONAL VIEWS OF TURBINES AND REDUCTION GEARS FOR SHIP PROPULSION.

**Consulting Engineer, General Electric Co., Schenectady, N.Y.

*From paper read before the American Society of Naval Architects.

experience no case of trouble with gearing has developed and no appreciable deterioration of gears has been observed.

One of the important reasons for adopting this type of gearing was that its design tended to afford a distribution of strains and means by which excessive strains would not be imposed upon any part through slight imperfections, distortions, or inaccuracies. The uniform success which has been accomplished with an entirely new product shows that this expectation has been amply justified. Some of the gears which have been used have been very imperfect, both in matter of material and workmanship, and have been used under extremely trying conditions. That they have not failed has afforded the strongest evidence of the general reliability of the method.

Character of Construction

The character of construction used in this gearing is shown by one of the drawings, Fig. 1. The gear is built up of a number of plates machined to a form which gives them the desired degree of lateral flexibility. These plates are put together, engaging solidly at the hub and also engaging on a narrow edge at the periphery. When so built together they form a solid cylinder which can be spirally cut in the ordinary manner. After cutting, the edge engagements are relieved with a small dividing tool so that each disk operates independently and is free to deflect laterally under the side pressure which results from its diagonal engagement with the pinion. The parts are so proportioned that this lateral deflection can at no time involve fiber strains which could possibly cause destructive fatigue. A very small amount of this lateral deflection is sufficient to afford the desired distribution of load, and this amount can easily be given without approaching dangerous periodic strains.

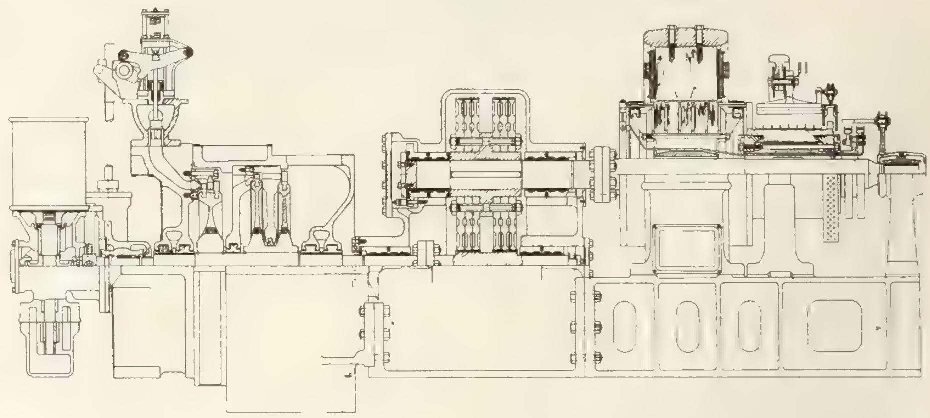


FIG. 5. CURTIS" 300 K.W. TURBINE GEARED TO GENERATOR—5,000 TO 1,000 R.P.M.

Value of Flexibility and Load Distribution

To appreciate the value of this flexibility and load distribution, various peculiarities of solid and spiral gearing must be considered. In the first place, where gears are inflexible, there must always be a tendency to increase strain at the loaded end of the pinion through torsional deflection of the latter. There is also a tendency to inequality of strain on different parts of the surface through the lateral deflection of the pinion under load. These inequalities can be partially compensated by elevating the bearings or evening the pressure on them, but this compensation can only be partial because the correction applies only to the two ends and not to the middle. Furthermore, the momentary and periodic strains on different points of solid spiral gearing may be seriously affected by vibrations of supporting structures, irregularities of machine work or gear cutting, and other causes. If for any reason such conditions cause any tooth or part of a tooth to receive periodically

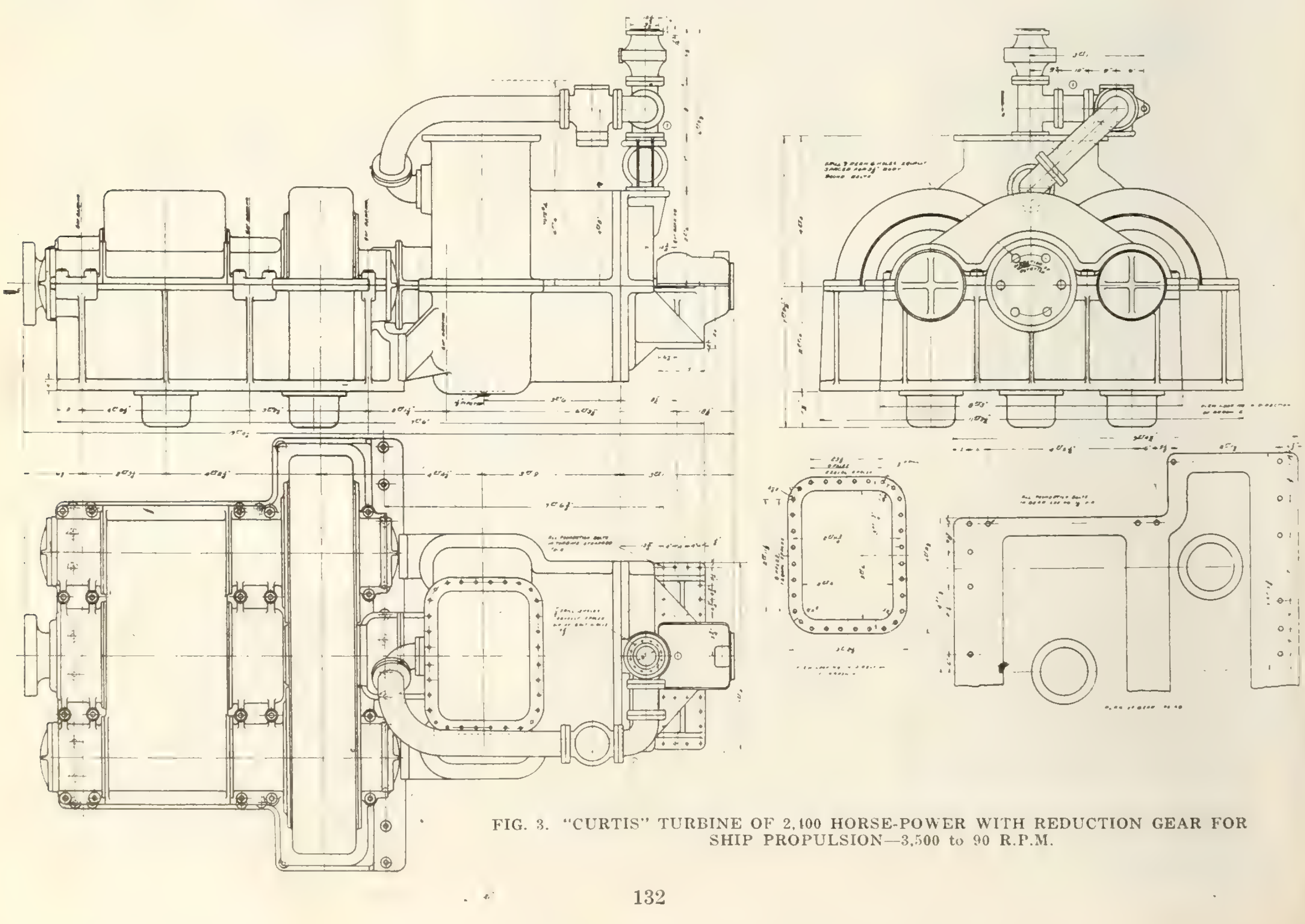


FIG. 3. "CURTIS" TURBINE OF 2,400 HORSE-POWER WITH REDUCTION GEAR FOR SHIP PROPULSION—3,500 to 90 R.P.M.

excessive strains, fatigue may result and a broken tooth may destroy the whole gear.

To obviate the possibility of breakage under such conditions, it is often desirable in solid gearing to use relatively large teeth in order that these possible irregular strains on teeth or parts of teeth will not involve danger of breakage. For other reasons, however, the use of large teeth is distinctly undesirable in spiral gearing. Spiral gears tend to engage by point contacts at or near the pitch line, and the ability of these point contacts to bear pressure without fatigue of the surface metal is governed largely by flatness of the surfaces engaging rather than by the size of the teeth carrying these surfaces. The flatness of the surface is a function of the pinion diameter and not of the pitch. If we double the number of teeth in a spiral gear we have twice the number of driving points in action, and the flatness of all of these points is the same in both cases if the pitch diameters are the same. These matters are illustrated in the sketches in Fig. 1.

With gearing of the Alquist type we can use very small teeth without any danger of incurring excessive strains on individual teeth, which might involve risk of the development of fatigue cracks. In this connection it should be borne in mind that experiments have shown that the strongest steel, if subjected to periodic deflections, will break after a fibre strain of 20,000 pounds per square inch has been applied a million or more times.

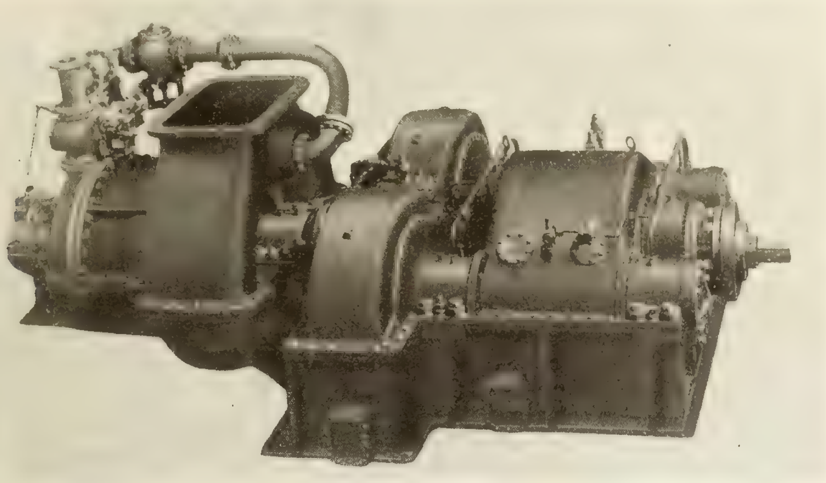


FIG. 6. "CURTIS" TURBINE AND ONE PLANE FLEXIBLE TYPE SPEED REDUCTION GEAR FOR SHIP PROPULSION.

Gear Applications

In the work which is now being done by the General Electric Co. gears of the type described are applied in three ways. First, a single reduction has been accomplished by engaging one solid pinion with a flexible gear of this type; second, by engaging a solid pinion with two flexible idlers, which idlers in turn engage with a solid large gear; and third, in a double reduction where a solid, high-speed pinion engages flexible gears on two countershafts, these countershafts carrying solid pinions, both of which engage a flexible gear on the same low-speed shaft. In these two latter applications the flexibility of the gears serves to equalize the loads between all of the driving points, and the use of a plurality of driving points on the large gear reduces the length of face necessary on that gear. These different methods of application are illustrated by diagrams in Fig. 2, and are also shown by the photographs and drawings of actual machines which are attached to this paper.

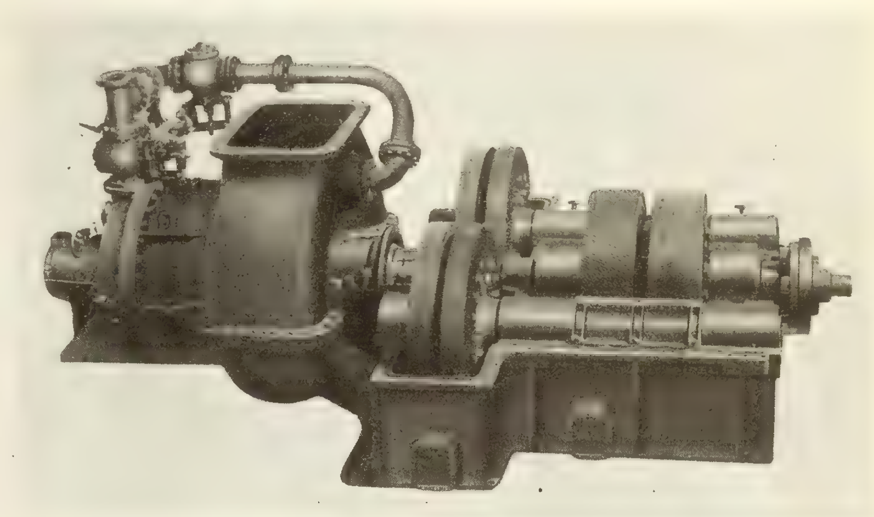


FIG. 8. "CURTIS" TURBINE AND ONE PLANE FLEXIBLE TYPE SPEED REDUCTION GEAR FOR SHIP PROPULSION. TOP HALF OF GEAR HOUSING REMOVED.

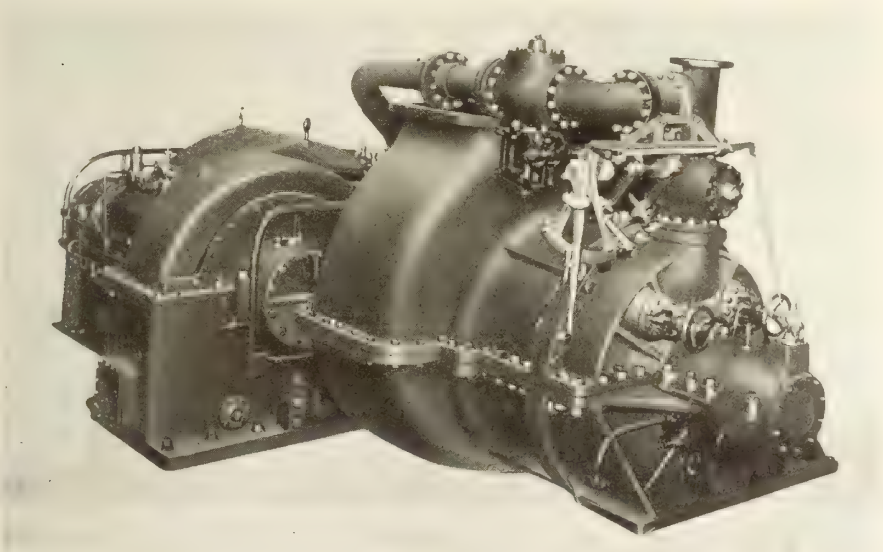


FIG. 7. "CURTIS" TURBINE AND ONE PLANE FLEXIBLE TYPE SPEED REDUCTION GEAR FOR SHIP PROPULSION, SHOWING CONTROL.

In both of these cases where a single high-speed pinion drives two flexible gears, other very positive advantages are accomplished. The pinion is relieved of bending strains, and pressure on the high-speed bearings is avoided.

Experiments have been made in Schenectady which carefully analyze the losses of high-speed gears under various conditions of load and pressure, and these experiments have indicated that low peripheral speeds are more efficient than high speeds. With solid gears, low speeds involve difficulties because they diminish pinion diameters and increase pinion lengths, thus complicating the troubles which may arise through deflection and torsion of pinions and pres-

sure upon pinion bearings. Since the flexibility of Alquist gears enables us to compensate easily for all possible degrees of torsional yield in the pinion, we can with such gears safely reduce peripheral speeds by making the gears longer and of smaller diameter. Such reductions of diameter diminish weight and improve efficiency, and the fact that the Alquist method makes such reductions possible constitutes one of its important advantages.

S. S. "LA BREA"

Voyage	Date	Total Distance in Knots	Average Speed in Knots per Hour	Total Barrels Delivered	Name of Port	Total Fuel Used Steaming on Voyage in Barrels	Total Barrels per Knots Steaming	Total Barrels Used in Port	Total Barrels per Knot Steaming and in Port	Time in Port, Hours	Barrels Discharged per Hour	Cost at 80c. per Barrel per Knot Steaming and in Port (Fuel)	Shaft Horse Power Hours	Pounds of Oil per Shaft Horse Power
1	Mar. 9 to 15 1916	650	9.5	62578	Oleum	574	.883	142	1.10	36½	1714	$0.88	116000	1.67
2	Mar. 15 to 26	2037	11.33	73600	Seattle	1459	.716	152	.79	37½	1962	.632	505000	.941
3	Mar. 28 to Apr. 6	2108	11.01	64676 8462	Vancover Seattle	1584	.751	155	.824	26 13½	2487 640	.659	530000	1.01
4	Apr. 8 May 16	9254.5	10.97	52109 19045	Taltal Anto-pagasta	6896	745	117	757	33¾ 15½	1544 1228	.605	233000	1.00
5	May 17 to 23	450	11.20	77292	Oleum	321	.713	134	1.01	39	1980	.808	118000	.911
6	May 24 to July 1st	9196.5	10.65	71824	Anto pagasta	6900	.75	109	762	25	2660	.609	2200000	1.06
7	July 1st to Aug 9	9186	10.39	71791	Port San Luis to Anto pagasta Chile and Return	6875	.748	107	76	42.3	1697	.609	2230000	1.04

Average speed. 10.9 Total pounds of oil steaming = 8270000 Total shaft horse power hours = 802900
Pounds of oil per shaft horse power = 1.03

S. S. "LOS ANGELES"

1	Apr. 9 to 15th	423	9.4	67674	Oleum	556	1.31	164	1.70	64½	1099	$1.36	74600	2.48
2	Apr. 16 to 25	1845	10.13	74739	Vancouver	1656	.897	218	1.01	33¾	2214	.808	394000	1.41
3	Apr. 27 to May 25	6549	10.22	73734	Panama	5579	.851	169	.877	46¾	1577	.701	1420000	1.315
	May 26 to 29	220	9.1	72372	Oleum	221	1.00	123	1.56	41	1770	1.24	39000	1.88
	May 30 June 27	6348	10.6	72538	Bal-Boa	5462	.86	159	.885	35	2072	.708	1460000	1.255
	June 29 Aug. 7-16	9151	10.24	71007	Port San Luis to Anto pagasta Chile and Return	8293	.906	186	.926	56.3	1261	.74	2130000	1.31

Average speed, 10.27. Total pounds of oil steaming = 7310000 Total shaft horse power = 538000
Pounds of oil per shaft horse power hour = 1.320

Ship Performance Comparison

The table shows a comparison of performances for two sister ships, the "La Brea" and the "Los Angeles," operated by the Union Oil Company of Los Angeles. Both of these ships are new, carry similar cargoes, and burn the same fuel oil in the same boilers under similar conditions. The "La Brea" is fitted with geared turbine equipment, and the "Los Angeles" is fitted with triple expansion engines of the best type. The "Los Angeles" is equipped with steam-driven oil-handling pumps of the ordinary type, and the "La Brea" is fitted with a new arrangement of pumps driven from the upper deck by General Electric motors. The table illustrates the superiority of the oil-handling machinery as well as that which propels the ships. The horse-power hours given in this table are calculated from the propeller and hull data given by the naval architect of the Union Iron Works who built the ships, and based upon model tank experiments which were made in Washington. The models of the ships are identical, the "La Brea" propeller operating at 90 revolutions per minute and that of the "Los Angeles" at 65 revolutions per minute.

The seventeenth voyage of the "La Brea" and the sixth voyage of the "Los Angeles" were made over the same course and at nearly the same time. The relation of fuel economy of these two voyages almost exactly corresponds to that shown by the average of all the voyages and tends to verify the accuracy of the whole comparison.

Cuts and data, courtesy of the General Electric Co., Schenectady, N.Y.

ZEEBRUGGE

ZEEBRUGGE is the seaport of Bruges, which derives its name from the fact that more than fifty bridges (Flemish "brugge") cross the many canals in and around the capital of West Flanders.

Zeebrugge is eight miles north of Bruges by rail, and six miles by way of the Canal Maritime, a modern waterway 230 feet wide, accommodating sea-going vessels with a draft of twenty-five feet. This canal terminates in the inner basin at Zeebrugge. The latter is protected from violent northwest winds by a crescent-shaped mole of concrete and masonry, a mile and a quarter in length. Crowning the land side of the mole are extensive warehouses, elevators and railway tracks. These elaborate harbor improvements were begun in 1895 and were under construction for twelve years, the cost exceeding $8,000,000.

Zeebrugge was the outgrowth of the reviving prosperity of Bruges. Before the war this one great mart of the Lowlands had begun to take on a new lease of life, with its thriving market gardens, its ceramic factory and its extensive lace works employing 6,000 hands. It would probably never have achieved the size and prosperity of its thirteenth century fame, when it is said to have had a population of 200,000, but it numbered more than 50,000 thrifty people in 1914, including a colony of nearly 3,000 English.

Zeebrugge is fifteen miles northwest of Ostend and sixty miles northwest of Brussels. One mile south of the harbor, on the road to Bruges, is an enormous old barn with great oaken beams, dating from 1280, the only relic of the once wealthy and famous abbey of Ter Doest.

STEAMSHIP "LA BREA," PROPELLED BY 2,600 HORSE-POWER "CURTIS" TURBINE DRIVING THROUGH "ALQUIST" REDUCTION GEARS.

SHIPBUILDING IN CANADA

By A. W. Robinson*

THE question of shipbuilding is an urgent one at the present moment. Steel vessels cannot be built promptly because the steel mills are sold out for ship plates nearly two years ahead and because skilled labor and shipyard equipment are also short and cannot be created quickly. We are therefore reviving the art of wooden shipbuilding and meeting with some success, especially on the Pacific Coast.

There are difficulties also in building wooden ships, among which are: First, skilled labor accustomed to the regular practice is scarce and not equal to the tonnage required; second, our sawmills turn out straight lumber, whereas the construction of ships, especially in their frames, requires many curved and irregular-shaped pieces, which it has been the ancient art of wooden shipbuilding to produce; third, the lumber available is unseasoned and will shrink and not make a good job when done. It seems to me, therefore, that the question should be taken up anew in the light of present conditions and requirements, and that we should not attempt to build a wooden ship on exactly the old lines or in the old manner.

Composite Construction Suggested

In making studies on the question, I have come to the conclusion that a composite construction would meet the case better than steel alone or wood alone. We can obtain steel angles and channels for the frames and also straight lumber in ordinary merchantable sizes. We can also get a certain number of handy woodmen and laborers who, though they cannot be classed as ship carpenters, could do plain work of this kind under instruction.

My suggestion is, therefore, that the vessels be built with steel frames, made of plain merchant sections, with a minimum of curved work, and that the remainder of the vessel, consisting of the beams, keelsons, deck planking and side planking, be made of wood in plain straight pieces as far as possible.

A vessel built in this way would, in my opinion, be more economical, both in first cost and in operation than an all-wooden ship, for several reasons, as follows:—

1—Very few curved wooden frames are required.

2—The work could be done largely by ordinary labor, under proper supervision.

3—The ship would be stronger than an all-wood ship.

4—It would have a greater cargo-carrying capacity as compared with the all-wood ship, on account of the reduced size and space required for the frames.

5—The fastenings of the woodwork to steel frames by means of screw bolts would be more secure than the old-fashioned drift bolts and spikes used with wooden frames, and could be tightened up as the wood shrinks.

6—The ship could be built more promptly and be a better job when done.

WOOD SHIP CONSTRUCTIO N IN BRITISH COLUMBIA.

*The author is a well-known naval architect in Montreal.

PIRRIE AND BELFAST

A WRITER in a recent engineering supplement to the Daily Mail Overseas Edition recalls that Lord Pirrie bears a name long and intimately associated with the best traditions of the north of Ireland and closely identified with the development of Belfast. His early ideals he derived from his grandfather, William Pirrie, a large shipowner of his time, who for over thirty years was the inspiring figure of the Belfast Harbor Board. Lord Pirrie has always cherished those ideals, while it has been his greatest satisfaction in life to be able to carry on and extend the public work of his grandfather, who first foresaw the great possibilities of Belfast and labored incessantly to make it a port capable of meeting the developments in shipping that he believed to be approaching.

The passage through Belfast Lough to the city was shallow and tortuous. Under the inspiration of Lord Pirrie's ancestor it was converted into a deep and straight channel. The new cut was opened on July 10, 1849, and named the Victoria Channel, in honor of Queen Victoria, the opening ceremony being performed by Mr. Pirrie, as senior member of the Harbor Board. Since the constitution of the Belfast Harbor Board in 1847 a Pirrie has always been associated with it, as was previously the case with its predecessor, the old Belfast Corporation. It is, therefore, on family as well as on business grounds that Lord Pirrie takes so great a personal interest in the welfare of the port and the city of Belfast, and has devoted so much of his life to the promotion of its prosperity. The growth of Messrs. Harland and Wolff, Limited, is, the writer goes on to say, one of the romances of industry. From the most modest beginnings the Belfast establishment has grown until now it covers over 130 acres of land and employs 17,000 workers.

Its expansion may be said to have begun about 1883, when engineering was added to shipbuilding by the erection of probably the most remarkable engineering shops of the world. Only those familiar with the site can realize the great constructional achievement represented by the erection of those shops on the mud of "the island." The establishment to-day may properly claim to be the greatest of its kind in the world; but under Lord Pirrie's direction important branches and allied works have been formed at Glasgow, Liverpool, and Southampton, for which a great future may be confidently predicted. At the present moment the workers of the combined establishments under Lord Pirrie's direction number some 45,000 individuals, representing a weekly wage bill of about £100,000. Since the outbreak of war these great works, putting their immense resources to the service of the national interests, have added vessels and machinery of the highest importance alike to the Royal Navy and to the Mercantile Marine, the latter hardly second in Imperial importance to fighting ships.

"A marshal was taking a couple of negro prisoners to the Federal Prison in Atlanta," said Capt. L. P. Woodford, of Georgia. "The unfortunates were from different towns and were strangers to each other until they had been rounded up by the minion of the law.

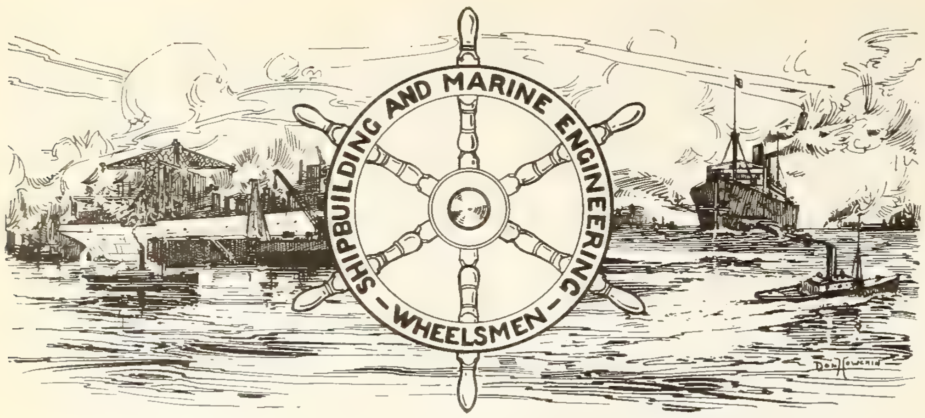
"As they were traveling southward to begin their prison sentences they engaged in the following colloquy:

" 'How long did the judge send you down for?'

" 'Three years.'

" 'How long you goin' down fo'?'

" 'From now on.' "



The success of shipbuilding and marine engineering enterprise is largely dependent on its "Wheelsmen." This series of articles has for its object the featuring in a racy, interesting and instructive fashion, the personal training, experience and achievement of those who to-day in Canada are energetically and effectively navigating the twin craft to higher degree prominence in their capacity as designers, constructors, outfitters, etc.

WALTER LAMBERT

EVENTS of the last few months have emphasized in no uncertain manner the extent to which Britain is dependent on her mercantile marine in the matter of maintaining a full larder in the "Tight Little Island." Present and prospective developments in the art of shipbuilding loom up with impending greatness, and the vital necessity of the present crisis imparts thereby a more than usual interest to the personality of the men behind the ships.

Walter Lambert, A.M.I.N.A. is a representative specimen of that type of Britisher whose availability at the psychological moment has, on frequent occasion in times gone past, served to maintain the supremacy of the British Empire, be the location north, south, east or west. A brief resume of our "Spoke's" career will serve to convince the reader that, no matter where the "Outpost of Empire," when necessity calls, a Son of Albion will be ready, possessed of the requisite scientific and practical training to "carry on."

Of English birth and parentage—he was born in Warwick, England, Jan. 31, 1884—Mr. Lambert would seem to have inherited those characteristics which prompt one to record that in this case a naval architect was born as well as made. Son of a father—an artist—and grandson of the owner of the first screw-propelled steamship on the river Tyne, Walter Lambert may well have felt an inner impulse in adopting his present vocation.

After receiving his boyhood education in Government High School, London, he attended the West Ham Technical Institute, taking special engineering subjects, preparatory to the adoption of his present profession. In this connection, it should be remarked that he earned the 1st class certificate for the advanced Stage of Naval Architecture in accordance with the South Kensington regulations.

At the age of fifteen he commenced his apprenticeship in the drafting-room of the Thames Iron Works, London, well known in the past as builders of battleships and among his experiences during the three years he spent here was that of attending the launch of the British battleship H.M.S. Albion by the present Queen, then Duchess of York. On this occasion the usually enjoyable and congratulatory features of the event were

WALTER LAMBERT.

utterly destroyed by the tragic drowning of thirty visitors due to a section of the staging being washed down by the backwash from the ship as it entered the water. The remaining two years of his apprenticeship were served with the Londonderry Shipbuilding & Engineering Co., at Londonderry in the North of Ireland, the miscellaneous mercantile types of vessels turned out at this yard proving a valuable complement to the more dignified and stereotyped war vessel work previously engaged in.

But, of making many ships, like making many books, there is no end and, applying the prophet's dictum to his own work, our "Spoke," on the termination of his apprenticeship, proceeded afield to satisfy his broadening vision and acquire that knowledge which cometh from experience. After two years spent as a junior draftsman with Armstrong Whitworth & Co., Newcastle-on-Tyne on construction of light cruisers and fast scouts for the British and foreign navies, Mr. Lambert joined the staff of John I. Thornycroft & Co., at London and later at Southampton and for eight years was engaged on the design of torpedo boats, destroyers, submarines, motor boats, shallow draft vessels etc., the successful specialisation in which has earned such a world wide reputation for that firm. Mr. Lambert became acting chief of design and foreign construction drafting-room before severing his connection with them to take up the management of the Canadian business of John Reid & Co., Naval Architects & Marine Engineers, Montreal and New York. Mr. Lambert recently completed four years in their service which he terminated in order to commence business on his own account. During his association with Messrs. Reid there was carried out the design and constructional supervision of two lake steamers, two dredges, one train ferry, one self-propelling grain elevator, half a dozen tugs and a similar number of hopper scows all of steel construction; four wooden steamers were also completed.

While nonpartisan in political and municipal affairs, Mr. Lambert has decided views on the present state of world affairs. He is a member of the 5th Royal Highlanders of Canada, and even as this is written, official recognition of the value of his ability is afforded in the announcement of his appointment as Superintendent of Construction to the Director of Steel Shipbuilding, Imperial Munitions Board.

In addition to the professional accomplishments indicated by the foregoing Mr. Lambert holds the position of surveyor to Bureau Veritas and is also Canadian representative of Fleming & Ferguson, Dredge Engineers of Paisley, Scotland. His social activities include membership:—Institute of Naval Architects, Great Britain; Canadian Fisheries Association, and Hudson Yacht Club. He is married and resides in Montreal during winter, while summer finds him either at Hudson, P.Q., or Lake of Two Mountains, where his favorite pastime of boat-sailing and water sports generally can be fully gratified.

As would be expected, our "Spoke" has positive opinions on all questions pertaining to Canadian shipbuilding, and has great faith in the future of the industry, provided it receives judicious encouragement from the Government along with proper financial backing from those engaged therein. The future personnel of the industry must also receive wise

training as well as encouragement, and, in this matter of training the future generation, Mr. Lambert believes that a decision ought to be made for a boy before he is fully competent or sufficiently experienced to form his own opinion. "After a boy is 12 years old his education should be suited to his intended line of business, especially if engineering professions are concerned because this age is the most valuable for the acquiring of new knowledge. I believe it would pay shipbuilding firms to take the greatest possible interest in their apprentices, allocating part of their time to purely scholastic and technical instruction. The example of Canadian Vickers is well worth emulating and enlarging upon in this connection,—they hold classes every winter, taking up naval architecture as a science under the direction of their naval architect.

The study of all technical journals bearing upon their business is of greatest importance to mechanics, young and old. Personally, I get through a dozen per month and though at times they pile up because of pressure of work, I regard the close study of modern developments made available by these journals as most essential to successful work."

U. S. S. CORPORATION TO BUILD CANAL BARGES

FOR the present the United States Steel Corporation is considering building nothing but steel boats, 12 feet depth, that will go through the barge canal. It was for a site for a plant for such construction that the corporation purchased through Joseph P. Day from the Newark Factory Sites, Inc., the half mile frontage on the Hackensack River adjoining the Newark branch of the Jersey Central Railroad. The tract embraces about sixty-two acres, running back 1,400 feet to Hackenseck avenue. Adjoining this property is another tract of eighty-eight acres, which E. H. Gary is considering purchasing, and if later on the Steel Corporation decides to go into the business of building larger vessels this property will be taken over and improved. It is understood that Chairman Gary, James A. Farrell, president of the Steel Corporation, and August Ziesing, president of the American Bridge Co., picked out the Hackensack River site after having made an exhaustive study as to railroad facilities, labor market, and depth of channel of all the tidewater property around New York. An important factor was the width of the river at the point chosen. The property is right in the centre of the Newark meadows and was partly filled when the Hackensack River was deepened recently.

The tract is midway between Jersey City and Newark and fronts about 1,200 feet on the Lincoln Highway. On one side is land recently taken by the Government for a wooden ship plant, and almost adjoining is the site of the Ford Motor Company's new $10,000,000 plant. The labor required to operate these new industries will roll up into the tens of thousands.

LACHINE CANAL TRAFFIC DURING MAY

THE shipping through the Lachine Canal in the month of May, shows marked decreases in almost every feature as compared with the corresponding month of last year. Grain shows a decrease of 1,358,161 bushels, eggs of 2,040 cases — almost fifty per cent., cheese of 5,801 boxes, and coal of 27,330 tons. Butter alone shows an increase. The total tonnage operated was 452,407 as compared with 523,999 last year, and the number of trips through the canal decreased from 968 to 936.

The total for each of the different grains shipped through the canal during the month in bushels is as follows:—

	1916.	1917.
Wheat	1,865,468	1,256,295
Corn	185,340	178,071
Oats	1,298,615	1,026,500
Barley	487,206	197,200
Rye	132,000	......
Flaxseed	99,598	52,000
Totals	4,068,227	2,710,066

The decrease in produce was equally marked with the exception of butter, which increased from 308 packages to 431. Eggs decreased from 4,186 to 2,146, and cheese from 18,649 to 12,848. Coal also showed a decrease, the total for May, 1917, being 218,512 tons, as compared with 245,842 for May, 1916.

The trips through the canal during the past month were 936, a decrease of 32, as compared with the same month of last year; the tonnage operated was 452,407, a decrease of 71,592 tons, and the cargo tonnage was 377,003, a decrease of 29,165 tons. The passengers through the canal, however, increased from 1,436 to 1,826. The number of light trips through the canal was 401 in 1916 and 383 in 1917.

HELIGOLAND

THE little island of Heligoland rises abrubtly out o fthe North Sea some thirty-four miles northwest of Cuxhaven. The Germans, since the cession of the island to Germany by the United Kingdom in 1892, have spent vast sums of money on it, in the effort to make it an effective naval base. They have built a sea wall of steel, granite, and concrete, twenty-five feet high, all around it; they have constructed a harbor for submarines at great expense; they have honeycombed the rock of its mighty cliffs, two hundred feet high, with galleries; in fact, they have done everything that could be done to transform the island into a "bristling fortress." What they have done, however, is as nothing as compared with what they have been credited with doing, by those who, with a sorry knowledge of the facts, insist on regarding Heligoland as little less than the key to the naval and military strength of Germany. Germany has, of course, done much to the island since the outbreak of the war, but how much is a question which could never, probably, be answered to everybody's satisfaction, because nobody, except the German authorities, knows.

The Heligoland of the days before the war was open enough for anybody to see. Many visitors in the summer months of each year were wont to seek out its shelving beach of white sand, and indulge in sea bathing, in climbing the high red cliffs and in walking about on the green Oberland. Yet the first thing that struck the new visitor must surely have been the smallness of the place, a little triangular piece of land just a mile long and barely a third of a mile across, only one-fifth of a square mile in all. Centuries ago, Heligoland was at least five times its present size, and a place of no small importance. Like so many islands, it had a peculiar attraction for the people of the surrounding mainlands. They stood in awe of it, and mythology early claimed it for its own. Here the Forseti, the god of justice, had a temple, and had also, according to another tradition, the goddess Hetha, a special object of veneration among the Angles of the mainland. Later on it was the realm of the pagan king. Radbod, and it was hither that St. Willibrod came, in the Seventh Century, preaching Christianity. But all the while the ownership of Heligoland was in dispute. Sea rover fought sea rover for possession of the island, until at last it became a fief of the dukes of Schleswig-Holstein. Even then, however, it had little rest, for when ever the dukes of Schleswig-Holstein found themselves in need of ready money they had a way of hypothecating Heligoland for loans advanced by the free city of Hamburg. Ceded to England in 1814, the island was, as already noted, transferred to Germany in 1892, and the Heligolanders did not welcome the change. They are not, as one writer clearly points out, Germans in any modern sense; neither have they, by race nor language, any affinity with the Dutch Frieslander. They are, indeed, generally supposed to be survivals of the Saxons who remained behind when Hengist and Horsa and his followers set sail for England. But whoever they are, they are no longer, if one may be forgiven the paradox, for according to all reports, the civil population of the island was removed within forty-eight hours of the outbreak of the war.

INSTRUCTIONS TO LAKE MARINERS

UNDER authority of law and of regulations prescribed by the Secretary of War to govern in case of obstructions in St. Mary's River, the following notice and instructions to mariners are issued by Lieut.-Col. Burgess, engineer officer in charge of river improvements:—

The Lighthouse Bureau has marked with two red spar buoys, carrying red lights at night, the channel bank of Pipe Island, opposite and above the wrecks of the steamers Pentecost, Mitchell, and Saxona. The wrecks lie about 1,500 feet south by west of Pipe Island light, with stacks and spars showing above water, and are marked at night by lights maintained by the owners. The available channel between the wrecks and Pipe Island bank, measured at right angles to the sailing line, has a clear width of only

about five hundred feet, of which width about four hundred feet is on the easterly side and one hundred feet is on the western side of the chart vessel course. Masters are warned that vessels must not meet or pass each other in the immediate vicinity of the wrecks.

The Coastguard Service has designated the small tug Minto K. as a special patrol vessel to oversee the passage of vessels in accordance with St. Mary's River rules. The patrol tug displays by day a United States coastguard flag and by night a vertical hoist of a red light above a white light. Masters are requested to co-operate with the patrol tug in keeping the channel clear and are notified that failure to comply with signals from that vessel will be punishable by penalty prescribed by law.

CANADA'S SHIPBUILDING PROSPERITY

IN the House of Commons, Ottawa, on June 1, the estimates for the Department of Marine and Fisheries were up for discussion, a circumstance which gave the Hon. Wm. Pugsley opportunity to bring forward his favorite theme of encouragement of wood shipbuilding construction in Canada and the Hon. J. B. Hazen, Minister of Marine and Fisheries to outline quite fully in reply what was at present being done both as regards wood and steel construction. The debate lasted for a whole afternoon.

The main point of Mr. Pugsley's contention was that the Government instead of spending money on highways should devote its energies toward aiding the building of smaller wooden vessels in Canada so as to help the coastal and inland water borne traffic which he said was suffering greatly by reason of lack of shipbuilding.

Hon. Mr. Hazen replied that the granting of contracts for 2,500 ton wooden ships only was a matter entirely within the control of the Imperial Munitions Board, which was acting under explicit instructions from the British shipping Controller. The Minister explained that he had brought the matter to the attention of the shipping controller and had suggested that smaller vessels might be ordered. He had received no answer to that communication yet.

In reference to demand for Government ship construction, Mr. Hazen pointed out that in the Maritime Provinces 48 wooden vessels were under construction. It was evident from the activity in the shipbuilding industry and from the fact that ships were sold at a good profit that there was no need for bonusing the construction of wooden ships in Canada at the present time.

"The question of building ships by the Government to be run in connection with Canadian railways is an important one and one to which consideration is being given," said Mr. Hazen, pointing out the necessity for moving carefully in view of the large expenditure that would be necessary and the difficulty of financing such an undertaking at the present time. So long as the profits were sufficient to encourage private enterprise the Government would not be justified in entering into competition.

E. M. MacDonald, Pictou, considered the Minister's statement unsatisfactory. Apparently the Government was content to rest upon what the British authorities were doing, instead of encouraging the building of ships for the Canadian coastal trade. The ships being built for Britain, he pointed out, would not supply the need for Canadian coastal vessels.

Hon. Mr. Pugsley insisted that the building of wooden ships was of primary importance to Canada and declared it was a mistake in view of this for the Government to propose spending $10,000,000 on highways. He read a letter from W. I. Gear, director of steel shipbuilding, stating that the Munitions Board had been authorized to build a certain number of wooden ships of approximately 2,500 tons each, 250 feet long and 40 feet beam. With regard to construction in eastern Canada, the essential point would be to satisfy the Board that suitable lumber could be secured, as they could not rely on getting this lumber from British Columbia, owing to freights and its use in shipbuilding there.

In view of this, Hon. Mr. Pugsley argued that as the Government controlled a Transcontinental railway they should utilize it for bringing suitable lumber from Prince Rupert to points in the east where ships of 500 tons and upward could be built.

Hon. Charles Marcil said there was a time when the mother province of Quebec shared with the glories of the Maritime Provinces in shipbuilding. All that had been said regarding conditions in the Maritime Provinces applied ten times more forcibly to the St. Lawrence with its immense traffic and the greatest port of Canada. He painted a gloomy picture of shipbuilding in Canada, declaring that there was an increasing shortage of tonnage everywhere, both on the ocean routes and on the inland waters. He, therefore, strongly argued that no time be lost by the Government in aiding shipbuilding so as to assist the carrying trade of the St. Lawerence and the Great Lakes.

Hon. Mr. Hazen replied that he hoped Mr. Marcil was generally better informed than he was on the question of shipbuilding. He produced figures showing that six large steamers were being built at the Vickers' Works, at Montreal, of seven thousand tons each, another vessel of 2,300 tons and several other vessels of lesser tonnage, while today 2,000 men were busily employed there. He also showed that a large amount of shipbuilding was being done by the Davies' plant at Levis, by private companies at Sorel, and that a company on the Isle of Orleans was building four wooden ships running from 1,500 to 2,000 tons each. The Minister said he had been informed by Mr. Norcross that a large quantity of British Columbia timber was being used in these vessels, a total of nearly a dozen being built at various points on the St. Lawrence.

Hon. Mr. Hazen then instanced a number of points in the Maritime Provinces where vessels were being built, while at Port Arthur five of 3,400 tons were being built, several large vessels at Collingwood, eight large steamers at the Polson Iron Works at Toronto, and a number of others at various points on the Great Lakes and other parts of Canada. The net result, he said, was to show that far from Hon. Mr. Marcil's contention being correct there was a very great activity in shipbuilding in Canada.

As to wooden vessels, Hon. Mr. Hazen said the British Government had issued an order excluding sailing vessels from the war zone, owing to their inability to escape from submarines, but this might not apply to vessels using auxiliary power.

SHIP SEIZED IN HARBOR

ACTING on authority of the Superior Court issued by Mr. Justice Allard, in the Practice Division, J. M. Ferguson, K.C., seized the steamship Steelton, in Montreal harbor, belonging to the Mathews Transportation Co., of Toronto, as security in the action taken by a seaman named Charles A. McCarthy against the company for damages under the Workmen's Compensation Act. The plaintiff states that in November last the mate of the ship ordered him to jump from the deck of the vessel and moor it to the St. Gabriel pier. It is alleged that no ladder or other means of descent were provided and plaintiff had to obey the order of his superior officer. In the jump of fifteen feet he was badly injured, and in his action for compensation he charges that the company is responsible for the "inexcusable fault" of their officer. Release of the ship was based on the company giving security which the Court fixed at $5,000.

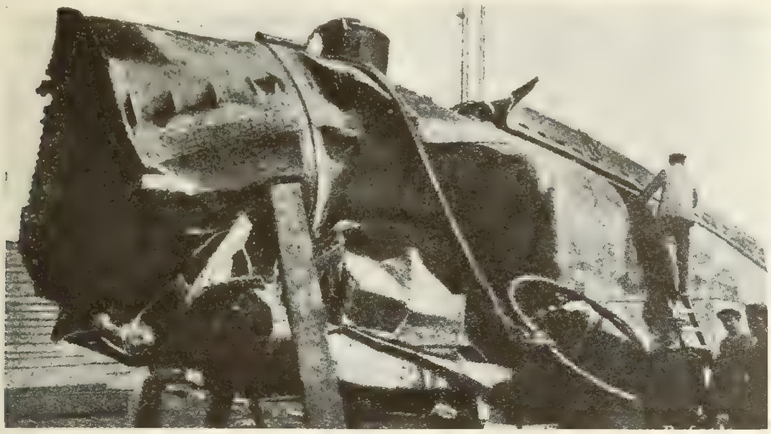
Sunset at 12 o'clock.—The habit of counting 12 o'clock at sunset is very ancient. The Turks, Greeks, and most other people in the Levant have almost always counted 12 o'clock from sunset and to this day the common people cannot understand that their clocks have to be changed every day and not ours. The Turks have officially adopted meridian time, but only since the Young Turks came into power—that is, since 1908. The change was even then not made immediately. It encountered a great deal of opposition on religious grounds because the Mohammedan hours of prayer are regulated by the sun, and the common people still stick to the old system. Only in Constantinople and Smyrna are there many Turks who keep the official meridian time, and the great majority of people, throughout the Turkish dominions still count 12 o'clock as their ancestors have from time immemorial, at sunset.

CONTEMPORARY WAR ARTICLES

Embracing Information and Data Drawn from a Variety of Sources Relative to and Arising from the Prosecution of this Many-Sided European War

RECOVERY OF A WRECKED SUBMARINE

THE recovery of a wrecked enemy submarine by the Italian Government in the Adriatic, and its successful repair and entry into the service of the Italian navy, has been accompanied by the publication of much interesting information concerning the doings of the craft, its origin and subsequent journey overland, etc., all of which facts in the light of past events, are conclusive proof, if any were required, of treacherous conduct on the part of Germany toward Italy when their relations were still nominally on a friendly basis. The captured log book gives full particulars of her ill-fated career and other documents establish the fact that she was a unit of the German navy, manned by a purely German crew, and was engaged in active hostilities against Italy many months before that country declared war on Germany.



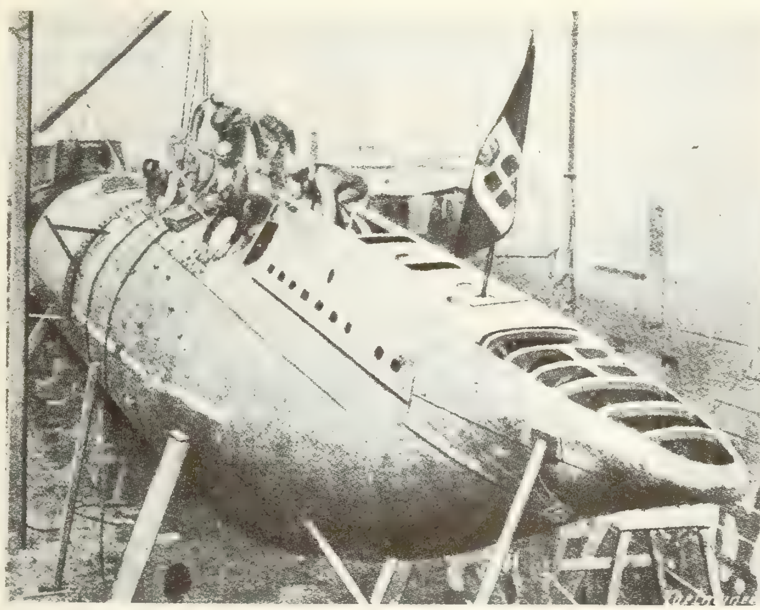
SHOWING EFFECT OF EXPLOSION ON MIDSHIPS SECTION OF HULL.

The UC-12 was a small submarine specially designed for laying mines. Her surface displacement is 190 tons, and when submerged is 210 tons. The approximate length is 110 ft., with a maximum diameter of 10 feet. A four-cylinder Diesel engine of 90 horse-power was installed, giving a surface speed of six knots, and a submerged speed of four knots. Six wells in the fore part of the vessel enabled twelve mines to be carried, these being released by a control in the conning tower.

The following report of the activity of the UC-12 while in enemy hands has been published by *The Engineer*, the successful conclusion of salvage operations by the Italian authorities being noted with pleasure.

The UC-12, according to her log-book, was one of the first two mine-laying submarines which Germany placed at the disposal of Austria-Hungary for the war against Italy. She was built at the Weser yard, Bremen, all her internal fittings being stamped with the name of Siemens-Schuckert. The launch took place at the beginning of May, 1915, and a few days later the boat proceeded through the Kaiser Wilhelm Canal to Kiel, where she arrived on the 17th, and at once embarked a cargo of mines. A month later, i.e., after Italy's declaration of war on Austria, she was dismantled, divided into four sections, and placed on a train, arriving at Pola on June 24, with her crew and commander. Here she was reassembled in four days, and again took to the water, intact as at first, and, as the Italian Government observes, "German in everything, from the imprint 'Kaiserliche Marine' on every chart to the German Imperial crown ornamenting the table service, and from the cap ribbons of the crew with the three letters B. A. K.—Bekleidungs- Abteilung, Kiel—to the numerous Iron Crosses found in her interior." On July 25 and August 15, she visited the neighborhood of an Italian naval base, and there laid two barriers of mines. In the following December she was at Cattaro, taking on board a cargo of rifles and ammunition, destined for the rebellious Arabs in Lybia. These were duly landed at Baria, near Sollum, on the coast of Cyrenaica, after which she returned to the Adriatic.

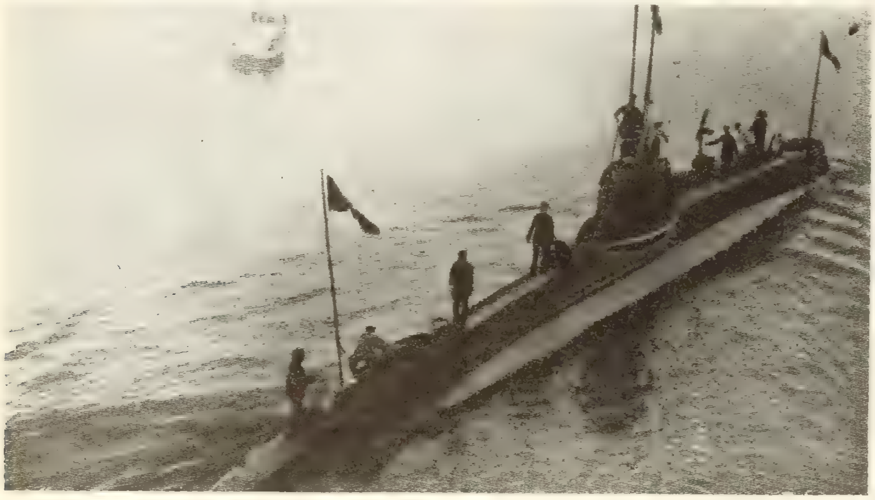
At the period when there was an abnormal amount of traffic between the two shores of the Adriatic in connection with the transport of the Serbian army, its impedimenta and prisoners — an enterprise which, by the way, was carried out without the loss of a single ship—the UC-12 was cruising off Durazzo, and distributing mines liberally in the roadstead. None of these, however, claimed a victim. After this vain attempt she paid another visit to Cattaro, and then lurked about for three days at the entrance to the Italian base where she had first put in an appearance. Here, it seems, she fouled one of her own mines or blundered into those which had been laid for the defence of the port. At all events, a dull explosion was heard, followed by an immense column of water, and the patrol vessels at once arrived to investigate the phenomenon. Divers who were sent down came upon the wreck of the submarine at a depth of nearly 100 feet. The explosion had blown her practically in two. The extremities were not much injured, but amidships the havoc was very great, as will be seen by the illustration herewith. The bodies of fourteen of the crew were found. Fragments of uniforms were discovered, together



RECONSTRUCTED HULL APPROACHING COMPLETION IN DRYDOCK.

with badges, cap ribbons, and other articles, which left no doubt as to the identity of the boat and her crew. A machine gun was also recovered practically intact. The cap ribbons bore such devices as "S.M.S. Vulkan," "S.M.S. Streited," "S.M. Unterseeboot VI.," "2 Minen-Abteilung," etc.

At first sight the wreckage seemed too complete to admit of salvage, but a closer survey convinced the Italian naval engineers that the reconstruction of the boat would offer no insuperable difficulties. The wreck was accordingly raised, in itself a task of no mean order, considering the great depth of the water, and placed on a slip for repair. The midship section, which had caught the full force of the explosion, had to be entirely rebuilt, while at the bow and stern new plates were fitted, the hydroplanes and rudders replaced and the shafting repaired. It is to be presumed that the original propelling machinery was hopelessly damaged, but on this point there is no definite information. Throughout the work special care sems to have been taken to preserve the characteristic features of the design. What remained of the coning tower was skilfully repaired, and such fittings as were still serviceable were restored. The task was finally completed, and it will be readily conceded that the result, as depicted in our engraving, reflects great credit on all concerned in the work. The UC-12 is now serving as a unit of the Italian navy, thought doubtless under a new name and one less suggestive of her Teutonic origin. It is interesting to note that, according to an official Rome communique of Jan. 13, another enemy submarine, the U-12, was sunk, and has since been salved and placed in commission. This appears to be one of the large German-built ocean-going submarines of 1,000 tons displacement, which had been ordered by the Austrian Government in 1912, and were due to be delivered in 1915. So far as the smaller UC-12 is concerned, the Italian naval authorities are to be congratulated on the highly successful completion of a piece of salvage and repair work which obviously called for no ordinary degree of patience and technical skill.



THE UC-12 AFLOAT AND IN SERVICE OF THE ITALIAN NAVY.

WATERTIGHT HATCHWAYS IN SHIPS

By J. J. Kermode, M.I.Mech.E.

DOUBTLESS the preservation of merchant ships is vital to the safeguarding of the food supply of the country and, even apart from that, the saving of shipping is of national importance. Despite however, the necessity of helping to proof ships against mines or submarine attacks, I have yet to learn that there is any provision in law to oblige shipowners to make secure hatchways on every deck below the weather deck so that water entering the ship from below will not reach the deck above, in case a ship is either mined or torpedoed.

Habit and usage of the sea have found shipowners or their representatives carrying out the practice of peace times, namely, making the weather deck hatches secure and weather-proof sufficient to meet all the ordinary or extraordinary inroads of seas landing on deck, but up to to-day no reasonable provision or care is exercised to prevent water in a lower compartment from reaching the compartments or hold immediately above. This seems unreasonable, even in peace time, but is fatal to shipping at the present moment. It is infra dig to provide watertight doors in the engine and boiler compartments and the shaft tunnel, whilst openings of 20 times their area are absolutely without protection of any kind, and it appears Gilbertian to have grave reports from a Government Commission on the question of bulkheads and their sufficiency when the question of the open highway for the inroad of water from below via the hatch openings is entirely overlooked.

Legislation could be enacted to ensure that all hatches should be so secured that they will resist water pressure from below as well as from above. All lower deck hatches should be made as secure and waterproof as the weather deck hatches save that instead of the lower deck hatches being provided with four tarpaulin covers, as is the usual practice for weather deck protection, six tarpaulins might be placed over the lower deck hatches after the latter have been caulked, and round the top of the combings under the tarpaulins from being cut and to ensure watertightness. Over the tarpaulins a netting of wire rope, of, say, 4 in. mesh, would give stability if secured in place by stretching screws fastened to the side of the hatch-combing or to the deck, the usual iron bar fastenings covering the whole and ensuring rigidity. It seems absurd in some cases to provide watertight doors in cross bunkers (which are under water when the ship is laden) and at the same time have the hatchway unsealed.

In order that ships of a given registered tonnage shall be able to carry a greater burden, I understand that in those of a certain class, freeing ports, fair leads, and bollards have been moved to the deck above that occupied by such fittings previously, thus increasing the freeboard of the ship. These innovations will only add to the risk unless precautions are taken within the ship herself to have every cargo compartment on all decks completely isolated and watertight as the injury which is likely to be caused by a mine or torpedo is generally of such an area that the most powerful salvage machinery would fail to keep the water under. Therefore, the obvious remedy is to prevent the water in the damaged compartment from reaching another compartment.

Another matter which I venture to think is worth consideration is the relaxation of the rule to maintain a fixed boiler pressure, especially in ships recently constructed, where the boilers might be pressed without risk to a higher pressure in case the vessel is pursued, and the extra speed attained due to the extra boiler pressure carried might enable the ship to escape.

SEIZED ENEMY SHIPS BEING QUICKLY REPAIRED

THE United States Shipping Board has issued the following statement in regard to repairs and outfitting of the German and Austrian ships which have been taken over or purchased since the outbreak of the war:

"The work of repairing and making ready for sea the interned German and Austrian vessels is progressing in an entirely satisfactory way. The Maia and Armenia have been made ready for sea and have been allotted to the French Government, the Portonia and the Nassovia to the Russians, the Clara Mennig and Pisa to the Italians. The Ockenfels is ready, practically, but has not yet been definitely allotted. These vessels are assigned to the Governments mentioned on what is known as 'trip time charters.'

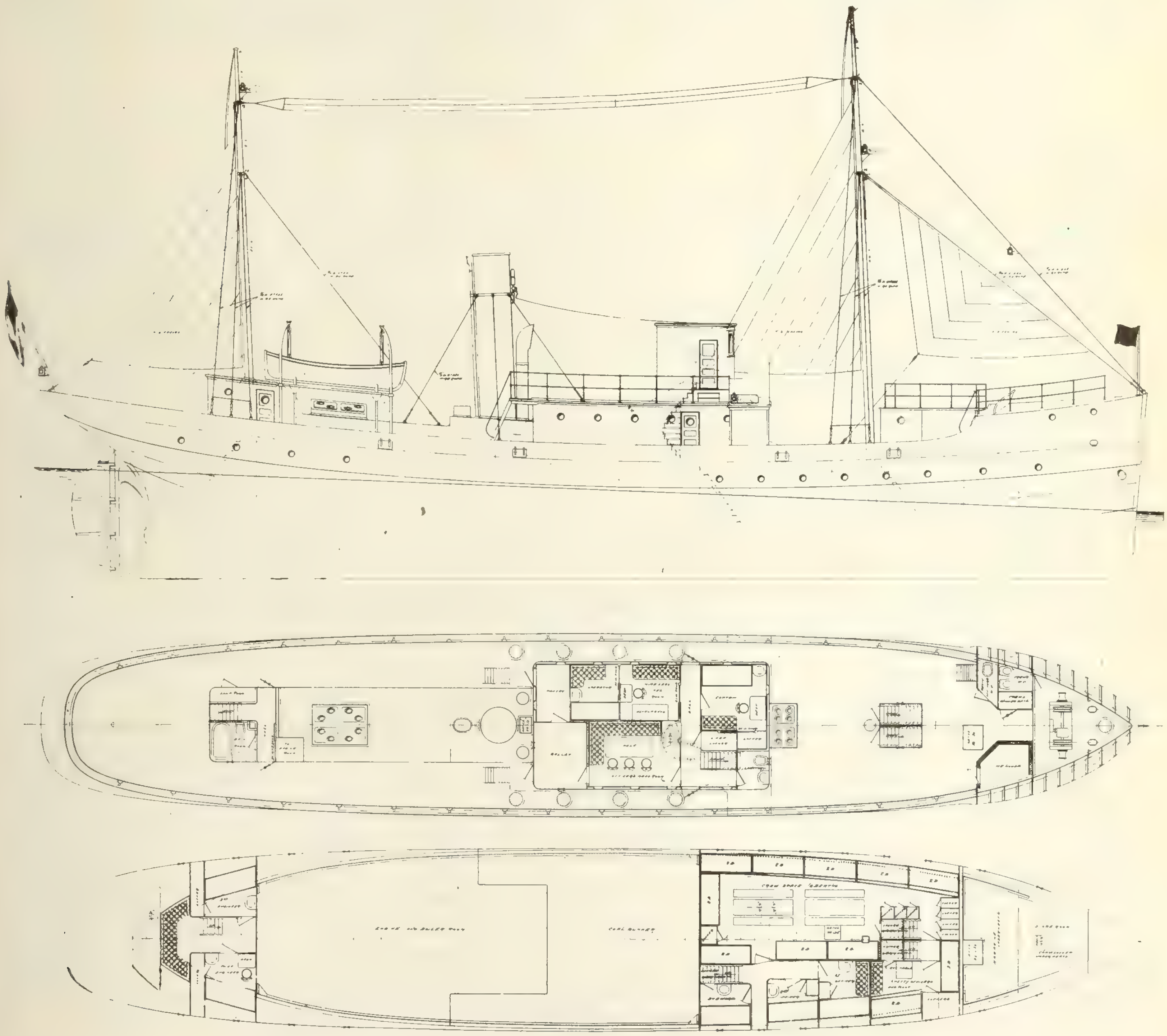
Furness Liner Torpedoed.—A cable received at Halifax, N.S., on June 12, states that the Furness Withy Co. S.S. Egyptiana had been torpedoed on her way way from London to Halifax. No mention was made of the fate of the crew. The Egyptiana was in Halifax about five week ago in command of Captain Williamson. She was a steamer of 2,467 tons register, and was built at West Hartlepool in 1905.

Fisheries Protection Vessels Launched at Toronto

By C.T.R.

Some quite appreciable evidence of the activity which now marks shipbuilding and marine engineering in Canada has been made available by the launch from the Polson Iron Works, Toronto, in one afternoon, of four trim little craft for our fisheries protection service. The choice of names by which each vessel, including two others, will be known—"Ypres," "Messines," "St. Julien," "Vimy," "St. Eloi" and "Festubert," is a happy one, paying as it does a graceful compliment to our soldiers—the dead, the wounded, and the unscathed, all of whom covered themselves with glory in the six named victories over the Germans.

AT intervals of from five to six minutes, beginning promptly at noon, Saturday, June 16, four out of six Canadian Government Fisheries Protection vessels under construction by the Polson Iron Works, Toronto, were released from the ways and transferred successfully to their native element in presence of several thousand spectators. The shipyard was gaily decorated with flags and bunting for the occasion, which was unique, in view of the fact that the quadruple launching is believed to be the first of its kind to take place on this continent, or for that matter anywhere. Tastefully flag-draped stands were erected for the accommodation of the specially invited guests, and from which the christening ceremonies were performed by Mrs. Hugh McKay and Miss Athlea Hazen, daughters of the Hon. J. D. Hazen, Minister of Marine and Fisheries, who was also present. Prominent among the builder's specially invited launching party were to be noted Admiral Kingsmill and J. G. Desbarats, of the Department of Naval Service, Ottawa; Col. Chambers, Chief Press Censor, Ottawa, who had been attending the Canadian Press Association Annual Convention; Mayor Church, H. A. Terrault, superintendent of construction, Ottawa; J. S. Irwin, Ottawa; Holt Gurney, T. A. Russell, R. R. E. Chisholm, Ottawa; Claude Macdonell, M.P.; Sir Frederick Stupart, T. H. Navin, Joseph E. Oliver, Captain James B. Foote, James Somers, George Gouinlock, W. J. McWhinney, K.C.; Capt.

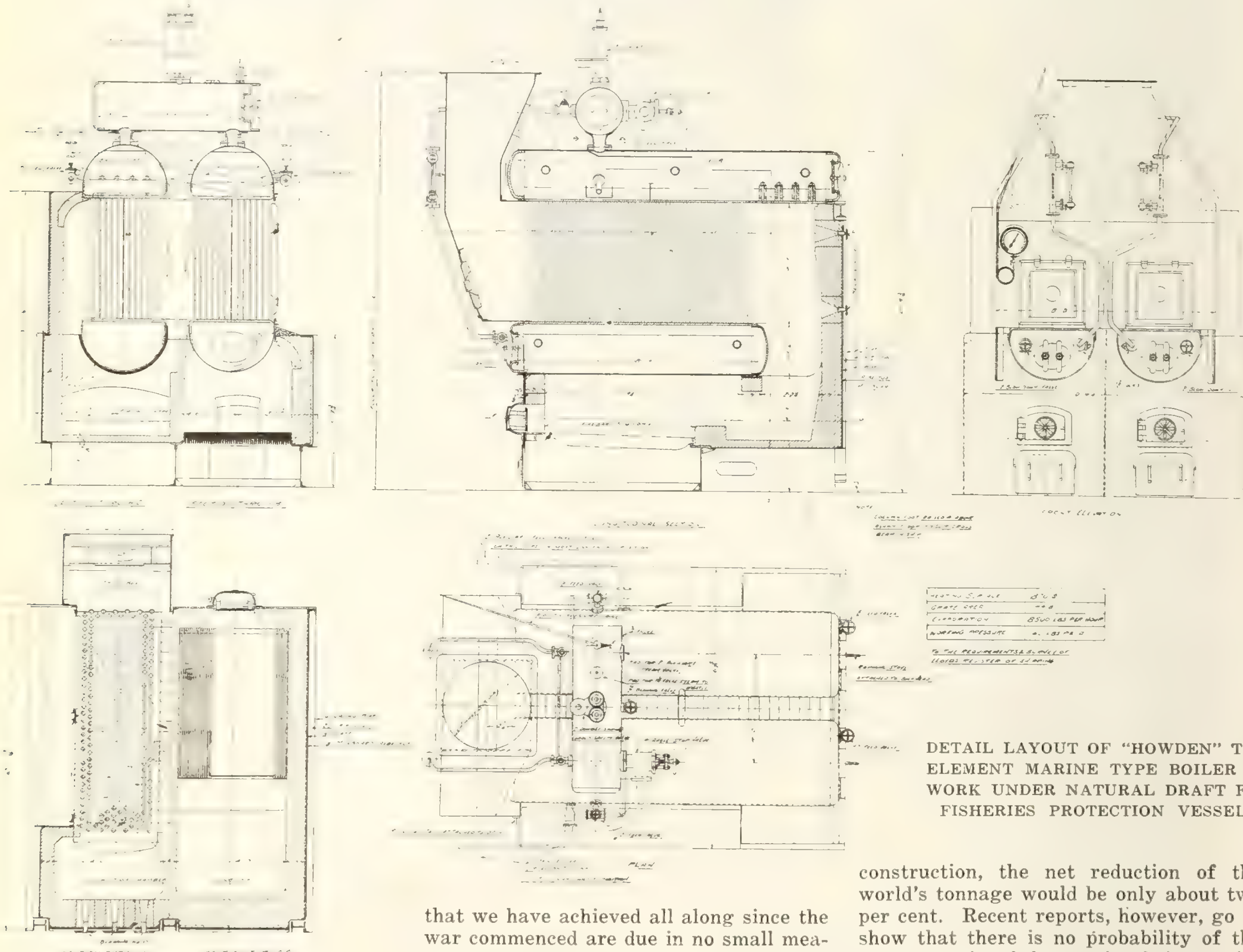


ACCOMMODATION AND RIGGING PLAN S, FISHERIES PROTECTION VESSELS.

J. J. Manley, Port Arthur; Capt. E. Winstrop and Capt. Resfnes, representing Norwegian shipping interests; Lloyd Harris, Capt. Harry Miller, W. B. Tindall, Arthur Taylor, John Sharpe, Peter Bain, A. Guy Webster, and Geo. E. Pearson, of the MacLean Publishing Co.; Acton Burrows, of the Railway and Marine World, and many ladies. Mrs. McKay and Miss Hazen were each the recipient of a sheaf of roses by the firm.

Rapid Progress Made

Only some twelve weeks have elapsed since the keels of all six of the vessels were laid, and with four of them afloat—"Ypres," "Vimy," "Messines," and "St. Julien," and with the other two—"St. Eloi" and "Festubert," following suit in about fourteen days' time, it will be at once appreciated that the shipyard management, despite labor scarcity and the difficulty of procuring materials of construction promptly, are deserving of the highest commendation for their achievement. Further, when account is taken of the fact that two months of the specified time limit of completion for all six vessels has yet to run, and that the propelling and auxiliary machinery, together with the hull outfit equipment, are ready to instal, it may be readily forecast that every one of the little craft will be on service on dates in every case ahead of requirement.



DETAIL LAYOUT OF "HOWDEN" TWO ELEMENT MARINE TYPE BOILER TO WORK UNDER NATURAL DRAFT FOR FISHERIES PROTECTION VESSELS.

Guests and Employees Entertained

Following the launching ceremony, a buffet luncheon was served to the invited guests in a large marquee erected within the yard. At the same time refreshments and "smokes" were served to the firm's employees by the management in another section of the plant, a proceeding which was greatly enjoyed and which demonstrates the interest taken by the executive in its employees, and which the latter in turn reciprocate by whole-hearted honest effort.

Hon. J. D. Hazen's Speech

After full justice had been done to the hospitality provided, Col. J. B. Miller, president of the Polson Iron Works, introduced the Hon. Mr. Hazen, who gave a short address on the shipbuilding situation from the executive viewpoint, and from which we quote as follows:—

"The successful termination of the war will depend, to no small extent on the ability of the British Empire and our Allies to maintain sufficient shipping to carry on essential trades. The successes that we have achieved all along since the war commenced are due in no small measure to the efficiency of the British and Allied mercantile fleets.

"Lloyd George has said quite recently that one of the best ways of carrying on the war was by the production of ships and then more ships. Let me remind you that the losses to shipping, as the result of submarines and other enemy agencies, since the commencement of the war have been enormous, even although they have not nearly approximated the boastful expectations and predictions of the Germans. They have, nevertheless, been serious, totalling up to the end of April last about 5,811,100 tons. How stupendous this loss is, you will understand when I point out that the replacement value approximates, if it does not exceed, one thousand million dollars. Notwithstanding these enormous losses, there is the comforting thought that the construction of new ships has during the period of the war been well maintained, more especially by Great Britain and the United States.

Construction Combatting Destruction

"Without entering into any details, I may say that the total of the world's mercantile marine tonnage at the close of 1916 was 48,683,136 tons. Even if it so happens that the present ratio of destruction should be maintained for another year or, say, until the end of June, 1918, if we maintain the present ratio of construction, the net reduction of the world's tonnage would be only about two per cent. Recent reports, however, go to show that there is no probability of the present ratio of destruction being maintained, and I ask your attention for a few moments while I submit a few facts as to what is being done in Canadian shipyards, to say nothing of the tremendous activity in ship construction in

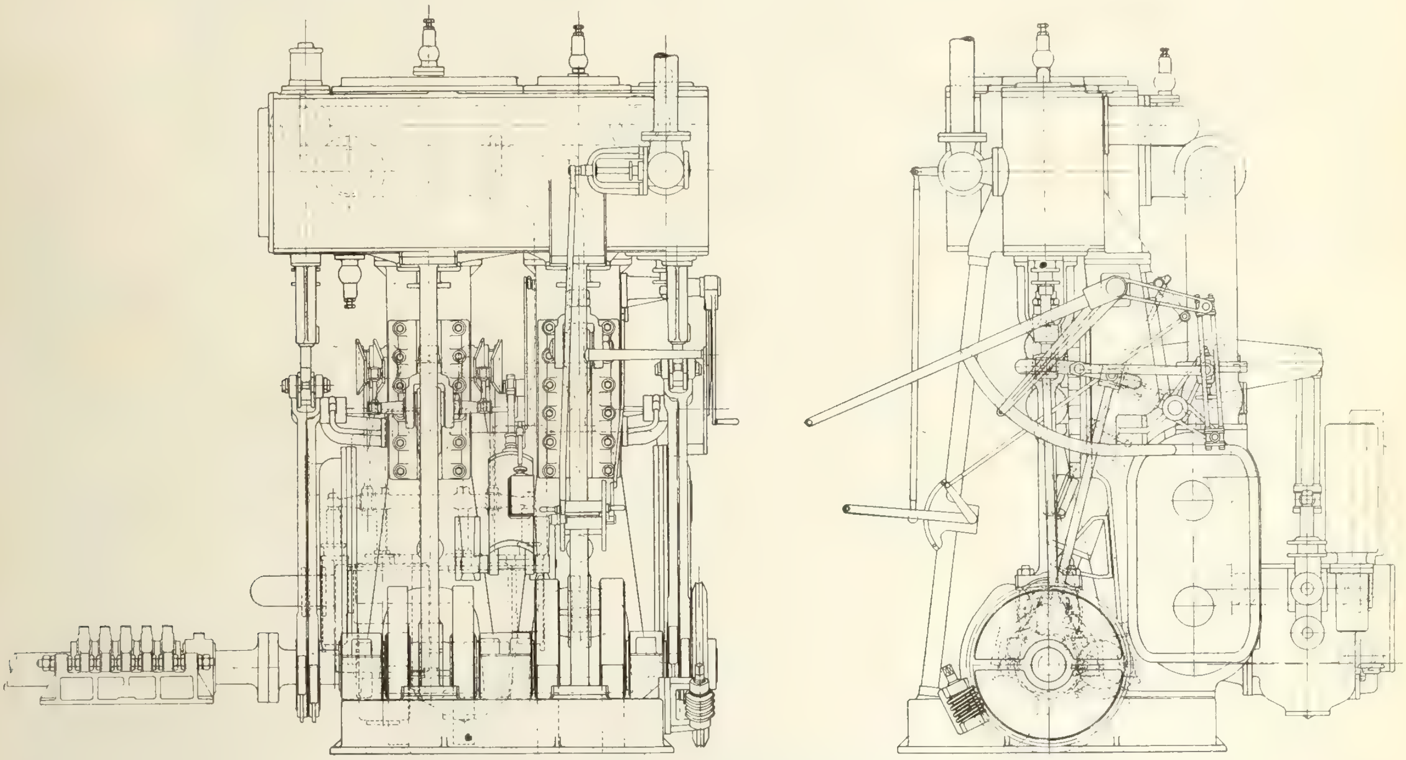
Great Britain and the United States and in Japan, to establish that there is conclusive evidence that the ratio of construction will be more than maintained.

"There are at the present time under construction in Canadian shipyards merchant steamers totalling approximately 150,000 tons carrying capacity. The cost of producing this tonnage will be in the vicinity of $25,000,000. In addition, there are building in various Canadian yards wooden vessels aggregating a total carrying capacity of about 30,000 tons."

On the call of Col. Miller, three cheers were given the Minister of Marine and Fisheries for his presence and address. Mr. Hazen, in reply, called for three cheers for Col. Miller, Mr. Newman, the shipyard staff and employees generally, following which on his lead, three cheers and a tiger were given for the King.

Vessel Features

The vessels are constructed entirely of steel equal to Lloyds' requirements and have the following principal dimensions. Length between perpendiculars 135 feet; breadth extreme 23 feet 6 in.; moulded depth 13 feet 6 in., with deck beam camber of 7 inches. They are built on the deep frame system with ordinary floors throughout and have a straight stem and elliptical stern. The propelling machinery is located aft, the stokehold being at the forward end of the boiler with bunkers adjacent capable of holding 180 tons of coal. The crew's quarters as also their mess room and that for the petty officers are forward there being accomodation for eighteen men. The cabin which is situated on the main deck forward of the smoke stack, has separate state rooms for the captain, chief engineer and first mate while there is also a bathroom and lavatory. On the main deck is located the galley with steward's and cook's room, also the officers' mess room and pantry. Above the cabin, forward, is the "Texas," embracing wheelhouse and chart room, wireless room, with operator's quarters in rear, and bridge opposite to door of the wheel house. Accomodation which includes a bath room for two engineers and second mate, is located aft below the main deck. Access is had from the main deck and also through a bulkhead from the engine room.



COMPOUND SURFACE CONDENSING ENGIN ES FOR FISHERIES PROTECTION VESSELS.

Constructional Details

The keel and stem are of mild steel 7½ in. by 1½ in., while the stern post is of cast steel equal to Lloyds requirements. The rudder is of the single plate type, with arms shrunk and keyed on to post, and carrying four portable pintles. The top pintle is fitted with a locking device to prevent rudder from lifting. The frames are of the deep type consisting of 5 x 3 x ⅜ in. angles with compensation in lieu of heel pieces. The floors are of steel plate 16 x 7/20 in. in the hold space, increased in thickness in engine and boiler space and flanged on top where required. The beams of 5½ x 3 x 10/20 in. angle on alternate frames are fitted with bracket knees of ample depth. The centre keelson is formed of channel bar. The main deck stringers are of plate 30 x 7/20 in., amidship, and are connected to shell plating by riveted angles 3 x 3 x 5/20 in.

The garboard strake is 9/20 in. thick, the sheer strake 11/20 in., thick, and the remainder of the hull plating ⅜ in. thick amidship. Riveting of shell plating seams is double throughout. The bulwarks are of 5/16 in. thick steel plate, rising 2 ft. 8 in. high above wood deck. Rolling chocks extend for a distance of 45 feet on each side of the vessel and are formed of 7 in. bulb bar, backed by 3½ by 9/20 in. angle. There are four freeing ports on each side fitted with strong hinged doors of the balanced type. Bulkheads are all of watertight construction. The two fresh water tanks are cement washed inside and have filling and air pipes, drain plug and hand pump. The decks are of British Columbia fir as are also the cabin floors, etc. The equipment consists of steam and hand steering gear in the wheelhouse, and a "Dake" steam windless fitted under the turtle deck forward. The foremast is 13 in., and the mizzen mast 11 in. diameter. Each vessel has two Bower and one kedge anchor. A ship's boat of wood is carried fully equipped.

Machinery

The propelling machinery consists of a fore and aft compound surface condensing engine having cylinders 18 in. and 38in. in diameter by 24 in. stroke. The high pressure cylinder is fitted with a piston valve and the low pressure with a double ported slide valve. The crank shaft 7¾ in. diameter is built up, counterbalance weights being attached to the cast steel webs. The couplings are also of cast steel. A separate thrust shaft with solid forged collars is installed. The surface condenser is cast on the engine back columns and contains 900 square feet of cooling surface. The air pump is of the Edwards type. The circulating pump, feed and bilge pumps are Blake-Knowles type, and are attached to the main engine and driven by levers attached to the low pressure crosshead. The propeller shaft

is fitted with bronze sleeves, while the stern-tube is of cast iron with a removable brass bush filled with lignum vitae. The propeller is of cast steel with four blades. A feed water heater is provided. The main steam piping is of seamless steel tubing with steel flanges, while all other pipes including the exhaust are wrought iron. The main boiler feed and blow off pipes are, however, made of copper.

Boiler Installation

The boiler is of the "Howden" combination sectional marine, two element, type. The total heating surface is 1870 sq. ft., the grate area 44 sq. ft., and the working pressure 180 lbs. per sq. inch. The evaporation available is 9,000 lbs. per hour from a combined heat absorbing surface of 1870 sq. ft., and 44 sq. ft., grate area using coal of not less than 12,000 B.t.u. per lb., and with .75 in. forced draught. There are two top and two bottom drums one set of two drums belonging to each element. Each element has 378 tubes of 2 ins. in diameter by 4 ft. 6 in. long between tube plates. Howden latest and improved type of forced draft equipment is fitted, an air heater being installed on the boiler front. Hot gases from the flues are utilized for this purpose. The drums of each element are connected by equalizing pipes while a steam drum connects the top elements for the main steam pipe connection. The boiler is tested by water pressure to 360 lbs. per sq. inch. The steel frame work supporting the boiler is designed and constructed to allow full freedom for any expansion that may take place.

A general service Blake-Knowles, vertical duplex 8-5-12 in. pump is installed to draw from the sea and fresh water tank, and to discharge to deck service and boiler. The sanitary pump 5½-3¾-5 in. is a horizontal duplex Blake-Knowles unit. Electric lighting for general and searchlight purposes is supplied by a 10 k.w. direct connected steam engine and generator. A complete evaporating outfit is installed having a capacity of 8 tons per day.

S.S. "PRINCE RUPERT" STRANDING

THAT the stranding of the Grand trunk Pacific steamer Prince Rupert on Genn Island, March 23, was due entirely to the frightful weather and that all officers of the vessel are exonerated from blame, was the finding of the Marine Court, composed of Capt. J. D. Macpherson, wreck commissioner, and Captains Clarke and Bucknam, assessors. The award was delivered on May 10, and reads as follows:—

"In the Court's opinion, the vessel after encountering the snowstorm was navigated in a careful and efficient manner, the engines were immediately slowed down, the whistle was kept going, and the master was immediately called, and a proper and good lookout was kept. No blame, therefore, can be imputed to Duncan Mackenzie, the master, or to Roderick Mackenzie, the chief mate, under whose charge the vessel was at the time, or to any of the other members of the crew. The Court, therefore, returns the last two named their respective certificates of competency."

The report goes on to say: "When the vessel left her wharf at Prince Rupert it was raining, with a moderate S. E. wind, but after passing the entrance to Prince Rupert harbor the weather picked up, the rain took off and the atmosphere became fine and clear. Between Spire Ledge buoy and Holland Rock, the light of which was visible, as also were Lawyer's Island light and all other marks, the master retired to his cabin, giving instructions to the chief officer to be careful to verify his position off Lawyers light, and to call him if necessary.

"The Court, therefore, is of the opinion that the master was perfectly justified in his actions, as the night was then clear and fine, and all lights and leading marks visible, combined with the fact that he himself had been on duty for about 9 hours, and was leaving the vessel in charge of an experienced and careful coast navigator, assisted by the third officer.

"This procedure is, as far as the Court is aware, the prevailing custom on the local passenger steamers plying in British Columbia waters. All went well until Lawyer's Island light was abeam at 1.36 a.m., where the ship's position was verified, Genn Island being observed just a little open on the port bow on a course S. 43 E., by standard compass. After passing Lawyer's light, the chief officer observed that a squall was coming over ahead of the vessel, and on realizing this he at once rang "stand by," left the wheel house, where up to that time he had been keeping watch, and went on the upper bridge, so as to have a clearer view.

"In a few moments, that is at 1.30 a.m., the ship was enveloped in a blinding snow and hail storm, all marks being obliterated. The engines were immediately put to 'slow speed,' the whistle was kept going and the master called; and after a few more moments the echo of the whistle was heard right ahead and both engines of the Prince Rupert were put 'full speed astern,' this occurring at 1.40 a.m., and one minute later, before the master had time to get on the bridge and before the way could be taken off the vessel, the ship struck on the reef off the north end of Genn Island, on the top of high water, at a time of tide which was one of the highest of the year.

"The Court considers that under the circumstances everything that could be done to avoid the disaster was done. The engines were slowed, whistle kept going, a competent lookout kept, and though no soundings were taken, the ship being nevertheless fully equipped for doing so, if necessary, the Court is of the opinion that in this case they would have been of no use.

"In conclusion, the Court wishes to place on record its appreciation of the manner in which all ranks and ratings in all departments of the crew of the Prince Rupert acted after the disaster. Discipline was thoroughly maintained and the safety, welfare and comfort of the passengers were the first consideration.

LINER RE-FLOATED AFTER TEN YEARS

THE former Kosmos liner Sesostris, which was salved by the British Columbia Salvage Company, after spending the last ten years on the beach at Ocos, Guatemala, where she was blown by a terrific gale and banked up by mountains of sand, arrived at Victoria, B.C., about the middle of last month. She was towed north by the C.P.R. tug Nitinat, and the B. C. Salvage Co. steamer Salvor went out to Race Rocks to meet her, carrying a number of local shipping men on board. As the fleet of vessels neared the Outer Docks the Nitinat and Salvor stood away and allowed the great black steamship to steam her own course for the wharf, with Capt. F. C. Stratford on the bridge.

Shortly before the liner went ashore at Ocos she visited Victoria, and the coincidence was remarked upon by shipping men that when she tied up recently it was at the very spot on the west side of the original R. P. Rithet & Company's wharf that she unloaded cargo over ten years ago. The salving of the Sesostris is admitted the greatest feat of its kind, and the local concern has added to its laurels by accomplishing something that several of the most expert salvage companies in America have failed to encompass.

Earthquakes Were Felt

During the floating of the ship several earthquakes occurred which almost upset the calculations of the salvors. For instance, to protect the work that was being carried on, a breakwater had been constructed to seaward of the channel through which the liner was being gradually drawn. There was no room between this and the breakwater in which to turn the vessel and when she was being taken out to sea a gap was cut in the middle of the breakwater to pass her through. By the time the Sesostris had been drawn half way through this breakwater, the work was almost entirely carried away by earthquake disturbances and the beating of the heavy seas from without.

The Sesostris while in port discharged the thousands of dollars' worth of wrecking gear which was used in getting her afloat, after which she proceeded to Seattle to be drydocked for cleaning and painting. From there she went to the Skinner & Eddy shipyard, where she will be made ready for sea. Hereafter the steamer will be known as the Frank E. Skinner. She is a vessel of 3,026 tons net and 4,800 tons gross. Her length is 380 feet, beam 50 feet and depth 30 feet. She has a speed, loaded, of ten knots.

Expedition Welcomed Home

Upon the arrival of the vessel at Vic-

toria, the local men aboard found a large party of their friends at the wharf awaiting them and they were given a warm welcome. Captain W. H. Logan, who proceeded to Ocos in November last to look after the work, on his arrival, although extremely busy, found a few moments to talk to press representatives, and gave a statement covering the expedition. He stated that the salvage company was greatly indebted to Sir Richard McBride, Agent-General for British Columbia at London, for the interest taken in the expedition, by which the Guatemalan Government and the British Consuls at Salina Cruz and Guatemala City rendered whatever services were possible.

The Tehuatepec Railway, owned by Lord Cowdray, also rendered valuable assistance through the same agency, supplying coal for the passage north and rendering many other services. In fact, this powerful influence was felt throughout the entire expedition. The

RE-FLOATED LINER TIED UP AT WHARF, VICTORIA, B.C.

expedition for the salvage of the SS. Sesostris was arranged for by the British Columbia Salvage Co. and the Skinner Syndicate, of Seattle, Wash.

Incidents of the Enterprise

Joseph Thebaud, who had had more or less connection with the Sesostris for several years, was the promoter for the scheme, and before entering into the matter, the Skinner Syndicate, after obtaining a report from Mr. Bissett, of Vancouver, as to the feasibility of Mr. Theboud's proposition and satisfying themselves that it was practicable, decided to enter into it.

The steamer Pilot left Victoria at the end of June, 1916, in command of Captain F. C. Stratford, called at San Diego, California, where much of the material necessary for the operation was taken on board. The Pilot arrived at Ocos, Guatemala, at the end of July, but owing to the difficulty of landing through the surf the heavy material for the operation work was not commenced until the middle of August.

The Sesostris lay in a small lagoon which had been made by pumping sand. This operation was performed by the then owners of the ship, and occupied more than a year. It demonstrated the fact that the drainage through the sand was sufficient to permit of sand being pumped, and this was the reason why the British Columbia Salvage Co. gave consideration to the expedition.

Owing to the accidents to the steamers Bear and Congress, the expedition of the Sesostris remained in charge of Captain F. C. Stratford until November, when Captain W. H. Logan arrived in Guatemala. During this interval the lagoon in which the vessel floated had been enlarged, so as to permit of her being turned at right angles to the position in which she originally lay, placing her so that she headed directly to sea.

Between the vessel and the sea was a barrier of sand. The ship rested in a placid lagoon, and on the other side of the barrier rolled continuously the breakers of the Pacific Ocean. The width of the barrier between the ship and the point at which she would float clear, was 650 feet. The salvage operation was, therefore, to cut through this barrier, amid the continuous surf which kept the sands always in motion, and haul her out to sea. The proposition was more or less a tidal one, and proved extremely difficult owing to the absolute lack of tidal data, and the fact that suitable tides occurred only three days during each month, thus rendering it necessary to work a whole month, holding the position gained, during one set of tides, before getting the advantage of the next.

Faced Many Difficulties

The entire operation bristled with difficulty and was a severe trial of patience and skill; the climatic conditions were severe, and the heat during the day was very great. The nights were warm and very damp. With the exception of the stings from scorpions, trouble with insects was not very great, as evidenced by the fact that there was no sickness contracted by any member of the expedition. To Capt. F. C. Stratford belongs the credit of having commanded the expedition until the arrival of Capt. W. H. Logan, of placing the heavy anchors in a precise and well calculated position, of studying and compiling the tidal data, and exercising general supervision.

Thomas Allan, with his assistants, Mr. Jens Johnson, Mr. W. L. Newell, Mr. Ernest Bishop, and Mr. Fowler Cardwell, were tireless in their work of doing the dredging necessary to bring the expedition to a successful issue, the continual moving of heavy pumps and suctions, the arranging and re-arranging of discharge piping which was always several hundred feet long, and each branch of which had to be carried over the lagoon on trestle work bridges built on pontoons, which necessarily changed as the vessel's position changed, and broke its jointing at each movement of the ship, was a work which, extending as it did over eight months, continuing every day, Sunday and holiday alike, Christmas and New Year's Day, would be quite impossibe to describe, and although it was hard work for all, too much cannot be said for the efforts of the engineers who carried, through sheer tenacity and perseverance, this discouraging and difficult work to a successful conclusion.

W. F. Newell and Mr. F. Cardwell were in charge of building a breakwater which at one time assisted materially in the floating of the vessel. This was a severe task; commencing as it did on the receding tide, they, with their men, began working in several feet of water, and frequently remained until the breakers of the incoming tide washed both officers and men off their feet.

Cut Wood from Forests

To Capt. R. Ridley belongs the credit for the fuel supply. In the early stages of the expedition wood was used and this was cut from the neighboring forests. It had to be contracted for with the native farmers and carried to the ship on a train. These people are somewhat difficult to deal with, and they had to be carefully watched. Keeping a steady fuel supply was, therefore, no pleasant task. Later, as executive officer of the ship, Capt. Ridley's duties were manifold, and well performed, his contribution to the success of the expedition being most valuable.

The floating of the Sesostris was due to the combined effort, good team work and perseverance of the men engaged in the work. Their task was a trying and frequently discouraging one. Having to do the same thing over and over again, day after day, in an effort to beat the eternal sea, is enough to take the heart out of any man, but this was the task accomplished by the members of the British Columbia Salvage Co., engaged in the floating of the Sesostris.

We are indebted to the Montreal *Gazette* for the foregoing synopsis of what constitutes both a unique and successful undertaking.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

SENTINELS OF THE DEEP

By Capt. Geo. S. Laing

TO a great many people an island is a piece of land surrounded by water, but to those who "go down to the sea in ships," an island is an ocean oasis. This article will refer to lonely islands far removed from the main continents as we know them.

Island of St. Helena.

Is there at the present moment a sea-girt rock that has more historical value wrapped up in its precipitious cliffs than grand old St. Helena? Could one view a more inaccessible mountain-top rearing its bald iron pate above the South Atlantic Ocean? No thinking person could leave memories of this stronghold buried in the mind's vaults to rot. Inspiration simply radiates from such an island.

To fully appreciate the value of an island it is necessary to imagine that you are in the shoes of a shipwrecked sailor, naval strategist, or cable company director. These are a few of the men who circle round ocean islands lying maybe from 500 to 1,500 miles away from the next island or continent. St. Helena is situated in latitude 15° 55′ south, and longitude 5° 44′ west. The southeast Trade Winds blow over it all the year round and roughly it is 1,000 miles from the African coast and twice that distance from South America. If it were imperative for any native of St. Helena to change foot-stools, his nearest neighbor would be the island of Ascension some 700 miles to the northwest and nearer the Equator. Take St. Helena from a sailor's point of view first.

We are homeward bound from Java, India or Mauritius in a sailing ship and have come round the Cape of Good Hope. In some cases we may not have seen land for two months and suddenly a man from aloft hails the deck with the words, "land on the lee bow, sir." In the morning glory of the tropics, the island—still forty miles away—looks like a tiny rain squall kissing the ocean from a surrounding clear sky. To those who have never lost sight of dry land its presence is commonplace, but the sighting of this little ocean rock kindles a fire in the thoughts of seamen, just as an Atlantic passage in a palatial steamboat becomes a revelation to thousands of land folks.

St. Helena's Inhabitants

Our craft is sailing along at six or seven miles an hour, with yards a little canted to port. The rain squall effect soon takes on a definite outline and the island now resembles a gasometer. Towards afternoon our craft is sailing along under the very frown of the island cliffs and two or three native whale-boats are towing from our lee rail. Their shades in features denote that the peon classes of this island are drawn from more than one or two original clans of black and white. One pleasant thing to note is their clean overalls of blue cotton, for apparently the island people believe in soap and water having a big say in their lives.

They have fish, vegetables, fruits and curios for sale, and one man from each boat comes on board while the others remain to bend on to a rope what may be hauled on deck. If our voyage has been long, appreciation of fresh vegetables and fruits is great. The curios consist of ladies' wrist bangles made from elephant grass seed or shells, and chatelaines of the same materials. Perhaps the "best seller" is a booklet of blank paper with ferns, mosses and yellow daisies sewn between the leaves. As these plants have been grown on the ground surrounding Napoleon's grave, their value remains with one for ever, and stirs up many allied associations of land asd sea. As this is written, the writer is looking upon some dried ferns and moss that he brought from this historical rock in 1890, so age would appear to work slowly with such stuff.

We now open out the lee side of the island and can see the Ladder Hill. The stairway with its 700 steps is very plain and appears like a white-washed streak from sea to mountain top. There is an anchorage under the only town—Jamestown, but unless we had sickness on board, or had run short of drinking water we generally sailed right on towards the next peak—Ascension.

A Natural Fortified Island

St. Helena is heavily fortified by Nature as it has only one safe landing place and that is very limited. Its precipitous rise from the ocean, with the exception of this small shelf for anchorage water, makes it a most defiant place. Napoleon was as safe on this rock as far as escape was concerned as one could possibly be. All together this warrior lived seven years in his island prison, and his ashes rested in St. Helena for nearly twenty-one years before they were given to France for re-interment in Paris.

The native boats have gone their way, we have taken solar observations to check our chronometers, while old St. Helena dips into the ocean astern. Although the island can only receive a short innings in such an article as this, it should be said, that from the sea one can find no trace of flora, but those who know the rock from its hidden interior tell us that woods, pasturage and foliage abound behind its iron rock-bound cliffs.

Ascension Island

Ascension is another valuable island. In raising this island from the South, the conical shaped mountain of rock and sand looks as hot and blistered as the shores of Suez or Aden in their desert ovens. We generally signal the vessel's name and port of registry to the flag station on the slope of the peak. This island is invaded sometimes by "rollers" which are huge crestless waves, twenty to thirty feet in height, rolling inshore at a good velocity and breaking like wild cascades on the beach, these unwelcome ocean babies make anchorages unsafe; but again, an island's value is wrapped up in such things. As a cable station and a naval and military possession, our Empire could do with more such places. Their isolation and inacessability are gems when it comes to strategical movements, alike in commerce, war, and communication.

Sea turtles visit the shores of Ascension and paddle themselves aground; then with flippers dug into the sand these peculiar creatures crawl slowly to a point ten or twenty feet above high water mark. Here, instinct tells them to scoop out a hole two or three feet deep and deposit the eggs for old Sol to hatch. As a layer, the turtle will take some beating, for one nest often contains 70, 80 or 100 eggs. The lady turtle only asks one quiet evening ashore to discharge her egg consignment, and as the sun is rising next morning she is launching her bath-tub body into the sea for another long trip in ballast.

Thus it is, that lonely rocks and islands in mid-ocean have a great value, although from a mineral or agricultural point of view they may be worthless. Bermuda and Sable Island are our lonely islands in the North Atlantic, but whereever they may be, their value to a maritime nation is beyond reckoning.

BABBITT WISDOM

By D. A. Hampson.

TO be successful in babbitting, avoid moisture and wear goggles.

Have the metal hot enough, but not too hot—the only right temperature is that when the babbitt will just light a pine stick—less than this is too cold to pour, more than this burns out the tin and injures the flowing and wearing qualities of the metal.

Heat more metal than you need—there will be less drop in temperature and no danger of the mould being only part filled.

Have the work as near the source of heat as possible—there is not the loss of temperature and of time and the danger

of accidents with molten metal is reduced.

Don't try to use too much old lead if you "mix your own."

Make sure that the weight of babbitt is not going to break loose the caps or dams—it is always a good plan to have a helper ready to clap a bunch of waste over a dam that seems to be giving way.

Make a good big pouring hole, or more than one hole—a ¼-in. hole is the smallest that anyone should attempt to use.

PASTE FOR OIL TIGHT JOINTS

By D. A. Hampson.

AN oil tight joint between metal parts which can not be conveniently packed or fused can be made by using a paste made of glycerine and litharge (oxide of lead). The powder is stirred in the glycerine until the consistency is like very heavy cream, and is preferably applied to the parts before assembling and the parts drawn together, squeezing out the paste as they are tightened up. If this cannot be done, the paste can be worked in at the edge of the joint, applying with a putty knife. It takes about two days for this mixture to harden ready for use. In one instance some sheet iron troughs, 15 feet long, were to be filled with oil and various shafts run in that oil. The ends of the troughs had to be castings set inside and held with screws. No satisfactory way of keeping these castings tight was found until the glycerine and litharge paste was used.

METHOD IN MAKESHIFTS

By J. E. McCormack

IN one instance, in the replacing of water gauge fittings after renewal of adjacent parts, the squaring up of the replaced gauge parts was done by using a carpenter's square having a sixteen-inch tongue, which, by the way, was longer than the water glass used.

When the fittings were apparently true, a glass was inserted and in a few days the third glass had been put in, the former two having broken. The fact that this number of glasses had not been broken during the two previous years altogether proved that the fittings were out of line. Being an isolated plant, there was no proper try-square at hand. A man who had been working in a plant a few miles away called in and seeing one corner of a broken window pane lying on a box, picked it up, examined it on the carpenter's square, then with it he tested the fittings without removing the gauge glass. Through checking his observations by reversing the piece of pane frequently he detected the errors in alignment. The water glass was removed, the alignment adjusted by using the piece of window pane for a try-square, and the water glass replaced. During the following twelve months only one glass broke, and then only to the extent of a hole in one side and caused by a foreign substance of low temperature coming against the said glass at this point.

The hint involved is, that in lining up articles for which a small try square is required but not at hand, it is sometimes possible to substitute some simple commonplace article and secure better results than could be obtained by the use of a square which though true is really too large for the amount of working room available.

By all means let us when possible have high grade tools—tools of a class designed for the purposes for which we require to use them but when we must substitute let us do so with an eye as to what can be quickly adopted to serve our purpose to the best advantage and without too much regard to actual market value so long as nothing is rendered useless for another time.

Resourcefulness counts when properly directed. Had a proper sized try square been quickly available, it would have been used in the first occasion mentioned above. The price of window pane had no market value but nevertheless it was more convenient than the square used and if it had been used at first there would have been time saved and the breakage and replacing of two extra glasses would have been avoided.

CHINESE OUTWIT GERMANS

THE seizure of the German vessels at Shanghai was effected without disaster, thanks to the astuteness of the Chinese officials in anticipating matters, otherwise the Deike Rickmers, Albenga, and Sikiang would have been sunk across the fairway, says Syren and Shipping. On March 13 it was expected the rupture would be announced on the following day. Acting on wireless instructions received during the night, at daybreak on March 14 the Chinese authorities put a boarding party on each steamer, arrested the crews, and sent them ashore. On the Deike Rickmers four bombs were found in the cylinders, each five inches in diameter and seven inches long, fitted with 15-minute electric fuses and battery. Three similar bombs were found on the Albenga and two on the Sikiang. All pins had been removed from the steering gear; the bottoms of the boiler water gauges closed, and water poured in; whilst the boilers had been emptied and the bottoms plugged; the copper unions of steam pipes had been removed and dummy joints substituted.

CANADA'S TRADE STATISTICS

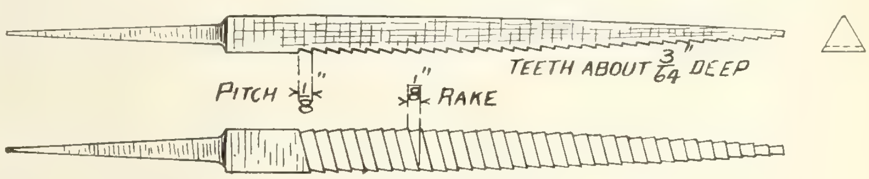
THE total trade of Canada for the four months of the year, leaving aside the gold figures and exports of foreign produce, was 683 millions, against 499 millions in the corresponding period of 1916, and only 276 millions in the corresponding period of 1915, increases of approximately 40 per cent. and 155 per cent. respectively. But of the gain of 184 millions, as compared with 1916, 115 millions fell under the head of imports, against a 69-million gain in exports.

"National revenues naturally continue buoyant under the large expansion in imports, customs collections in April, for instance, being $13,875,485, against $9,797,365 in April, 1916," says the *Journal of Commerce*, Montreal, "but our interest obligations have increased with heavy outlays for war expenditure, and the main dependence for keeping the position steady, while the inflow of new capital for development is checked, rests in establishing and holding a favorable trade balance—in selling abroad a good deal more than we buy."

RASP FOR SOFT METAL

By H. Coomber.

THE rasp shown in the accompanying sketch will be found very useful in cutting down aluminum, solder and other soft metals, as it does not clog up and cuts very quickly; metal-pattern makers will find it very handy in trimming of solder on gated work. It is easily made; a file of suitable shape is softened, and then the teeth are filed to the dimensions given, a six-inch half-round file being used for this purpose. It is best to leave the rasp soft, as it keeps the edge for quite a satisfactory length of time, and can be quickly filed up sharp again.



RASP FOR SOFT METAL.

This tool is best made from three-cornered, square and half-round files; the half-round and round will be found very useful in getting around a radius. The file may be bent, if desired, about two inches from the point, which facilitates getting at sunken portions of the work.

Vancouver, B.C.—The British steamer Ikeda of Vancouver, which was launched last month, is now formally registered from Vancouver, the papers having gone through at the Custom house here a few days ago. The vessel was built at Stockton-on-Tees by Richardson, Duck & Co., Ltd., for the Union Steamship Co. of British Columbia, of which E. H. Beazley is manager. She is 410 feet long, 52 feet 7 in. beam, and 29 feet 5 in. deep. She is 4,760 tons net register, 9,935 tons displacement, and will carry 8,800 tons of cargo deadweight. She has 2,000 indicated horse-power, which give her a speed of ten knots, and her triple-expansion engines are 26, 42 and 70 by 48-inch stroke.

Accessory Equipment of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that determined effort is being put forth to initiate not only the design and construction of standard type ships for specific services, but that of their motive power—main and auxiliary reciprocating steam engine equipment, as well, with a view to acceleration of output and higher duty sea performance, this series of articles, describing and illustrating at least the more important instruments and accessory apparatus of the engine and boiler rooms seems to us more or less timely. The detail features of the various mechanisms will be discussed at length, also their specific application and utility scope.

CONCERNING INDICATOR DIAGRAMS—II

TO TAKE a diagram, a blank card is stretched smoothly upon the paper drum, the ends being held by the spring clips. The driving cord is attached and so adjusted that the motion of the drum is central. The cock is opened to admit steam to the indicator till the parts have become heated, which will be after a half-dozen revolutions. On being shut off, the pencil or marking point is brought in contact with the paper, the stop screw is adjusted, and a fine clear line traced upon the card. This is the atmospheric line. The cock is then opened, and after two or three revolutions the pencil is again applied and the diagram taken. If it is desired to ascertain the condition of the valve adjustment, the pencil needs to be applied only while the engine is making one revolution, but to determine power, it should be applied a longer time, so as to obtain a number of diagrams superposed on the same card. The fluctuations in the admission of steam, produced by governors which do not regulate closely, are so common, that this course should always be followed to obtain average results. The diagram having been traced, and the cock shut, the pencil should be applied lightly to the paper to see that the position of the atmospheric line remains the same. If a new line is traced, it is evidence of error or derangement, and the operations should be repeated on a new card.

It is well to mark upon every card the date, time of day, and end of the cylinder from which it was taken. In adjusting the valves, the boiler pressure should be observed, and the changes that are made, before taking a diagram, noted on the card for reference. If a series of diagrams is being obtained for power, they should be numbered in order and the number of the revolutions noted, either upon every card, or, if the speed is nearly constant, upon every other one. If tests are to be made for power used by machines or tenants, a number of diagrams should be obtained under each condition and the result averaged. It is well, in these cases, to mark each card of a set by some letter of the alphabet, and on the first of the set specify the machines at the time of operation.

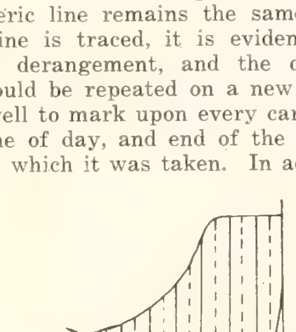


FIG. 2. DIAGRAM DIVIDED INTO TEN EQUAL PARTS AND HEIGHTS MEASURED MIDWAY BETWEEN EACH.

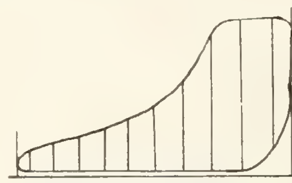


FIG. 3. DIAGRAM DIVIDED INTO NINE EQUAL AND TWO HALF PARTS, HEIGHTS BEING MEASURED ON CONTAINED DIVISION LINES.

Special Instructions

When accurate work is desired, too much care cannot be exercised in indicating an engine, and a further consideration of some of the points to be observed will aid the engineer in realizing their importance. Short steam connections of large bore from the cylinder to the indicator are desirable in all cases, and absolutely necessary with high speed engines. Avoid all turns, if possible.

The best cylinder oil should be used for this purpose. The piston should be removed, and the cylinder and piston cleaned and oiled every half-dozen diagrams. The oil contained in the steam is not sufficient in any case to lubricate the piston. A lack of lubrication will make a jumpy action in the movement of the pencil showing a series of steps, not waves, on the diagram.

On slow speed engines the lightest spring that will accommodate the pressure is best, but in high speed engines a heavier spring is necessary for the same pressure, in order to resist the movement of the pencil bar and connections, and to prevent their inertia from distorting the diagram. A waving line is the result of too great a movement of these parts.

The tension of the spring in the paper drum should in all cases be just sufficient to keep the cord tight; but this means that a greater tension must be used with high than with low speeds, to prevent the inertia of the drum overwinding itself and distorting the diagram; breakage of the cord also frequently results from this cause.

The tension of the cord is of no importance with slow running engines, but when indicating high speed engines it is desirable that the cord should always be kept taut, whether the paper drum is running or not. A good plan is to fasten one end of a rubber band to the driving cord four or five inches from the end, attach the other end of the band to the indicator just below the carrier pulley, so that it always keeps a tension on the driving cord. Make a loop in the end of this cord for hooking on the indicator, and the loose end admits of readily connecting and disconnecting without allowing the driving cord to become slack.

With slow speeds, a length of 4 in. to 4½ in. will show well proportioned diagrams, but as the speeds increase the diagrams must be shortened to avoid the effects of the inertia of the paper drum; and at very high speeds an instrument with a small paper drum should be used. Diagrams at very high speeds should not exceed 2 in. in length, and frequently 1½ in. will give better results.

The pressure of the pencil on the paper should be just sufficient to make a legible mark, and no more; a great pressure creates friction and consequent inaccuracy in the diagram. Water in the indicator will make a curious but not a useful diagram, and therefore care should be exercised that the indicator is thoroughly heated up before a diagram is taken. Again, if much water is entrained in the steam, it will be necessary to leave the cylinder cocks slightly open while taking diagrams, as otherwise a distorted diagram is almost a certainty.

When taking diagrams from steam engines, the height of the barometer or pressure of the atmosphere should always be carefully noted. This is necessary when the economy of the engines is to be considered, and it is desirable in all cases to know how much the exhaust pressure is above zero. Even at the sea level the pressure is constantly changing, and there are many engines working at places far above the sea level where the atmospheric pressure is always less, and in some cases very much less, than 14.7 lbs. per square inch,

FIG. 4. LOOP DIAGRAM FROM NON-CONDENSING ENGINE CARRYING A LIGHT LOAD.

or 29.92 in. of mercury. Care should, therefore, be exercised in this respect, as there is a tendency among engineers to ignore this fact.

All gauges in ordinary use indicate pressures above the atmosphere if pressure gauges; or if vacuum gauges, the amount below atmospheric pressure; but neither kind shows the pressure above zero, or total pressure, and to arrive at this, the pressure of the atmosphere must be added to the gauge pressure in the first case, or the amount of vacuum substracted from the atmospheric pressure in the second.

Horse-power from Diagram

The work done by the steam in the cylinder of an engine is measured by the product of the force exerted on the piston into the distance through which the piston moves, and is usually expressed by the term foot-pounds. If, for example, a force of 33 lbs. per square inch on a piston having an area of 100 square inches is employed to drive the piston 100 times over a stroke of 4 feet, the work done by the steam amounts to 1,320,00 ft. lbs. The amount of horse-power which the steam develops is the foot-pounds of work done in a minute divided by 33,000. In the example given, the horse-power developed when 100 strokes are made per minute is 1,320,000 divided by 33,000, or 40 horse-power.

The force exerted upon the piston is given by the indicator diagram, but as it varies in amount at different points of the stroke, it is necessary to determine the equivalent force which, acting constantly, would produce the same result. This is done by computing from the diagram what is termed the mean effective pressure. The product of the mean effective pressure, expressed in pounds per square inch; the area of the cylinder, expressed in square inches; the length of the stroke, expressed in feet; and the number of strokes per minute, which is twice the number of revolutions per minute, gives the number of foot-pounds of work performed per minute. This result divided by 33,000, gives the amount of horse-power developed.

To compute from the diagram the mean effective pressure, two lines are drawn perpendicular to the atmospheric line, one at each end of the diagram and the intermediate space divided into 10 equal parts, with a perpendicular at each point of division. To secure these divisions a radial divider is quite generally employed.

Radial Divider Used

Draw a line across the paper at each end of the diagram at right angles to the atmospheric line. Next place the diagram so that the line on the right hand of the diagram comes over the right hand line of radial board, then shift the diagram up or down until the left hand line on same meets the left hand line on board, then touch in the ordinates, set the card upside down, and in the same way touch in the points at foot of card.

The determination of the mean effective pressure consists next in finding length of the various perpendicular lines found by the use of the radial divider. (Fig. 3.) This may be done by measuring each line with the scale and averaging the results. A better and quicker method is to employ a strip of paper, one of the cards upon which the diagram is traced if desired, and mark, one after another, the various distances on its edge, making thereby a mechanical addition, and requiring only a final division by ten, which will give the mean effective pressure.

In non-condensing engines carrying a light load, the expansion line often extends below the back pressure line and forms a loop in the diagram, as is shown in Fig. 4. In computing the mean effective pressure in such cases, the distances below the back pressure must be subtracted from those above the line.

FISHERMEN V.C. AND THE KING

Tom Wing, M.P., tells how he accompanied a fisherman from a mine-sweeping trawler, who was awarded the V.C., to Buckingham Palace to receive his decoration from the King.

"He rolled along with me in true seafaring style," says Mr. Wing. "Until as we approached the gates, I remarked. 'We must pull ourselves together, otherwise we shall not be admitted.' My gallant friend who had been chewing a plug of tobacco, took it out of his mouth and carefully put it in his cap.

"It is usual for the King to shake hands with recipients, and when he did it on this occasion my man would not let go. He held on, and to make certain it was all right, he put his other hand on it. Then he looked at his Majesty as much as to say: "Are you the King, or are you only "kidding" me?"

"When we got outside he said it was all like a dream, and he felt for his pipe to make quite sure he was awake."

BETHLEHEM STEEL TO CONCENTRATE ON SHIPBUILDING AFTER WAR

IT NOW appears that shipbuilding will be the backbone of the Bethlehem Steel Corporation after the war. Shipbuilding will more than make up any loss occasioned by a falling off in munition orders. Bethlehem Steel now has 135 ships under construction, and enlarged capacity will enable it to increase its annual output of vessels. A strong feature can be found in the fact that Bethlehem will consume its own steel in the manufacture of ships, thereby assuring activity for a large percentage of its steel plants. It is estimated that the shipbuilding industry of the country will operate full for at least five years after the war. That Bethlehem Steel will reap great benefits from this industry is evident from the fact that it recently controlled 40 per cent. of the shipbuilding industry of the United States.

Bethlehem Steel will complete the last foreign shell contract in August of this year, and will not have to seek additional munitions orders to assure full activity for its mills. The extraordinary demand for steel from domestic sources will give Bethlehem all the work it can do for the remainder of the year at least.

OPEN LETTER TO THE KAISER

A CORRESPONDENT of the New York Times writes the following open letter to the Kaiser, describing for his edification the advantages of the simple life on the Isle of St. Helena with its memories of other shattered dreams of world conquest.

You may go to St. Helena soon, I understand, but you are probably too busy fighting for your existence now to find much time for general reading. So I will tell you about St. Helena.

St. Helena is a pretty eight by ten island in the South Atlantic. The nearest land is Ascension Island, 700 miles away, and the nearest mainland Africa, 1,200 miles east. The best way to reach St. Helena is by boat. A battleship could drop you there and call back again once a month to see if you were all right.

The cliffs of St. Helena rise to the height of 1,000 feet, and the view from the top must be entrancing to a man who yearns as passionately for a free ocean as you do. You could stand up there and look at a free ocean for miles in any direction. As far as your eye could reach you would never see a submarine blowing up a passenger ship. The seas around St. Helena are probably the freest in the known world, and I hope you may be spared to enjoy the sight of them.

One of the nicest things about St. Helena is that it lies 4,477 miles away from England. While visiting the island you would not need to worry all the time for fear of being attacked by the soft, cowardly, rabbit-hearted English. You would not need to sleep in your spurs, with a gun under your pillow and your sword hanging on the foot of the bed, because England and Belgium would be too far off to jump on you without warning as they did so treacherously in 1914. After you had been at St. Helena a few years perhaps you would feel so safe that you could venture out in the yard without your weapons. There's no place like an island for a militarist with nerves.

St. Helena is really the lid of a volcano, but you have sat on the lid of a volcano for thirty years, so you wouldn't mind that. The climate is temperate and salubrious. The Hotel Longwood, where Napoleon stayed, is still standing. Queen Victoria presented it to the people of France some years ago, but doubtless it could be rented from the French nation. You need a good rest after your hard fight for the freedom of the seas, and I'm sure there is no place where you could get rest better than at St. Helena. The island was settled originally by pirates and about 3,500 of their descendants remain to this day, so you would have just enough congenial society without being overrun with it. Now I must close and take a run down to the bulletin boards to see if your brave little U-boats have made the seas any freer than they were yesterday.

Launching Pressure Calculations and Vessel Motion*

By P. A. Hillhouse, B.Sc.,, and W. H. Riddlesworth, M.Sc.M., Eng.

The paper describes a method of calculating launching pressures and moments, which takes accurate account of tide, declivity and camber effects. In addition, a form of fore poppet, which has been developed and successfully used by the Fairfield Shipbuilding & Engineering Co., is featured, as are also some model experiments undertaken for the purpose of determining the actual motion of a vessel during the whole process of launching.

THE FORE POPPET

THEORETICALLY, when the stern of a vessel rises during her launch, she is supported partly by the buoyancy of her immersed portion and partly by a single upward force exerted by the groundways upon the forward edge of her foremost poppets. As this edge has no area, the intensity of the pressure is theoretically infinite. In practice, due to crushing and consolidation of materials, the load is distributed over some unknown length of the forward make up, and the local intensities of pressure thus brought down within limits which can be dealt with. To assist in obtaining this result

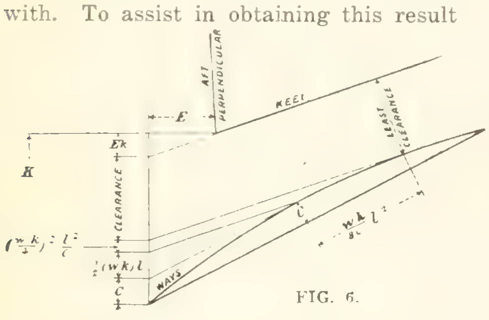


FIG. 6.

layers of soft crushable wood packing are sometimes inserted between the poppets and the upper surface of the slidingways. It is impossible to determine exactly what length of the make-up is actually called upon to assist in supplying the support required at the fore end of the ship, but if we are to make any working estimate of the strength to be provided, some assumption must be made. In the cases of the largest vessels launched during recent years at Fairfield, we have assumed that the total theoretical load upon the fore poppet would be distributed over the length of about 30 feet. The mean assumed load per foot run of ways was therefore one-thirtieth of the total load, and half of this on each side of the vessel. It was then assumed that the longitudinal distribution of this load could be fairly

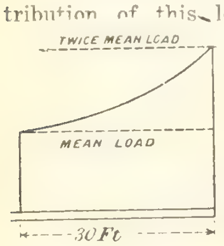


FIG. 7.

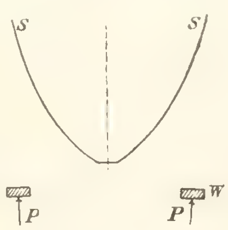


FIG. 8.

represented by a portion of a parabola (Fig. 7), the value at the after end of the 30 feet being equal to the mean load and that at the fore end twice the mean load. The total load thus to be provided for was 1 1/3 times the theoretical load.

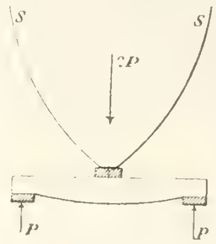


FIG. 9.

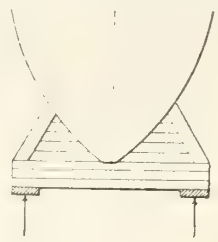


FIG. 10.

The separate poppets included in the 30 feet were then made strong enough to withstand the load indicated by the portion of the load-curve in way of each, with a factor of safety not less than 3.

Form and Strength of Poppets

Let SS (Fig. 8) be the transverse section of the vessel's bow in way of any single poppet and P the upward force to be supplied by the ways W. The problem is that of constructing some form of cradle or strut to transmit the force P from W to S. If there would be no tendency for the vessel to capsize when supported only by her buoyancy aft and the fore poppets forward, and if the keel were sufficiently high above the ways, this would be most simply effected by means of a cross beam of steel and/or timber stretching transversely from way to way and supporting the vessel at the middle line as shown in Fig. 9. Cross logs were used in launching H.M.S. "Terrible," though in this case the load was not concentrated at the middle of the beam as shown in figure, but distributed more or less evenly on beams and ways by means of diagonal struts and packing as indicated in Fig. 10.

In most cases, however, it would be found difficult to obtain sufficient strength with wood logs or sufficient "give" with steel beams to ensure a proper longitudinal distribution of the total load over the required distance. The common method is to support each side of the vessel from its own way, and to devise the most convenient and suitable method of strutting apart the two mutually inclined surfaces—the horizontal surface of the way and the more or less sloping surface of the ship's side. Either vertical or inclined struts may be adopted (Fig. 11). Vertical poppets will be longer than inclined ones, and will therefore be capable of a greater amount of crushing and adjustment to assist in distributing the load. But in the case of a vessel with very fine sections forward vertical poppets would either become so long as to be in danger of buckling out sideways, or would not meet the section at all except at an impracticable height. In any case some means must be devised to prevent slipping between the ship's side and the top of the poppet. If a sloping strut be placed normal to the slope of the vessel's side there will be no tendency to slip between poppet and hull, but it will be necessary to tie in the lower end of the poppet to prevent it from sliding outwards across the ways. If the poppet be placed at some angle intermediate between these two limiting positions ties will be required both at head and heel.

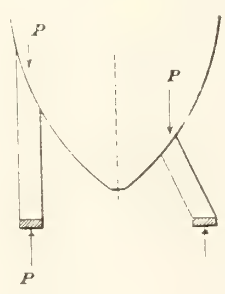


FIG. 11.

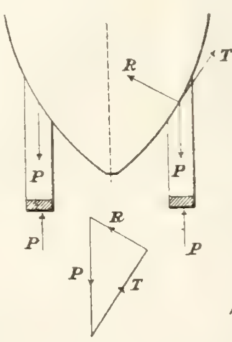


FIG. 12.

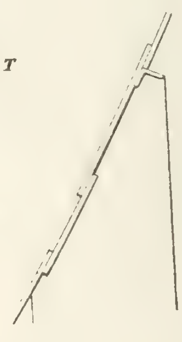


FIG. 13.

FIG. 14.

Vertical Poppets

When the poppets are vertical their upward thrust P is transmitted to the hull by two components—a normal pressure R and a tangential force T, the triangle of forces being as shown in Fig. 12. There is no transverse compression of the hull, since the inward horizontal component of R is balanced by the outward horizontal component of T. Internal shoring, if found necessary, need therefore be in a vertical direction only. For small vessels resistance to the tangential force T is often obtained sole-

*Part II. of a paper read before the Institution of Naval Architects, March 29, 1917.

ly by fitting the poppets closely against the lower edge of one or more outside strakes, an angle bar being sometimes introduced to increase the bearing surface for the woodwork (Fig. 13).

This method was successfully used in launching R.M.S "Campania," then regarded as a "monster" vessel, though as a precaution the heads of the poppets

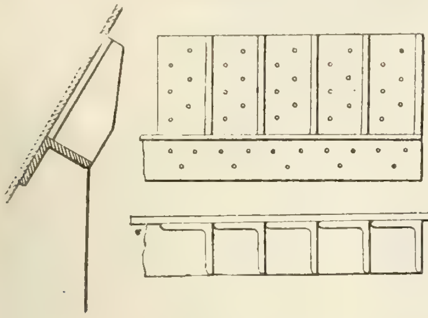


FIG. 15.

were also bound by chains passing from side to side under the keel. The launching weight was 9,100 and the total pressure upon the fore poppets about 1,800 tons.

For heavier vessels and large loads on the fore poppet it has become common to obtain resistance to the tangential force by riveting a steel shelf to the shell plating (Fig. 14). The shelf is supported by bracket plates at frequent intervals and it is not difficult to obtain a sufficiency of rivet connection between shelf and hull. This shelf is often made of considerable breadth and fitted with an outer angle to stiffen its edge between the brackets and to hold in the poppets. The "Mauretania" rested on two shelves, each 3 feet six inches wide; for the "Ocean" the shelves were each 6 feet in width, and covered the whole breadth of the vertical poppets. Such a construction appears to be objectionable for two reasons. In the first place its under surface is irregular, and will probably have numerous rivet heads projecting from it. This renders it difficult to secure a good fit between shelf and poppets, and will therefore tend to produce irregular increase in pressure at some points and an entire absence of

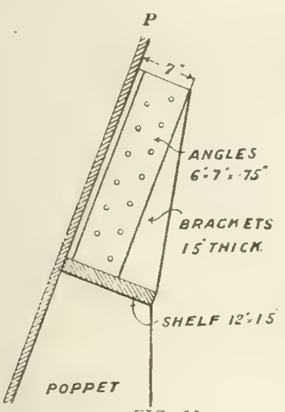


FIG. 16.

pressure at others. To some extent of course this variation will be reduced when the load comes on and the more severely loaded portions of the poppets crush. But it is conceivable that if the fit were not perfect the whole of the load might be concentrated upon the outer edge of the shelf, and so produce considerable strains in the unsupported portions between the brackets, and even buckling the brackets themselves. For all large vessels launched at Fairfield in recent years—beginning with H.M.S. "Commonwealth"—we have for this reason used a very narrow shelf, and have supported it as closely as possible by vertical angle bars. The form first used is shown in Fig. 15, and consisted of a longitudinal angle bar, 6 inches by 6 inches by ¾ inch, supported by short lengths of the same scantling placed vertically as close together as possible and fitting closely against the longitudinal bar, though not connected to it. This method makes it easy to obtain the necessary rivet area. The tangential force is very directly transmitted to the rivets, and there is no danger of the flange of the single bar being bent upwards, even although the whole load should by chance be concentrated on its outer edge.

Irregularity of Fitting Surface

There still remains, however, the fact that the surface to which the upper ends of the poppets are to be fitted is somewhat irregular. The poppets have

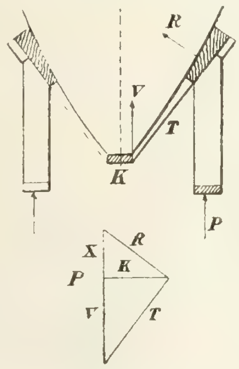


FIG. 17.

to be notched out to fit the angle bar, and holes dug in them to receive the heads of the rivets connecting it to the hull. All this tends towards bad fitting and non-uniformity of loading. In later jobs this difficulty was avoided by replacing the longitudinal angle bar by a stout plate not connected to anything, but merely placed hard against the lower ends of the vertical angles so as to form a smooth surface for the poppet heads (Fig. 16). The supporting angles can be of any required length, placed hard together at the fore end of the make-up where the load is greatest, and reduced in length and spaced more widely apart as the loads are reduced towards the after end. If the angles are riveted directly to the shell plating, the shell should, if possible, be kept above the expected water-line, so that they can be removed when the vessel is afloat.

"Banjo," or "Swing" Plate Device

In order to avoid piercing the vessel's hull by the numerous rivet holes involved in the method just described, a "banjo" or "swing" plate is sometimes fitted, passing from the heads of the poppets on one side right under the vessel and up to the poppet heads on the other side. The shelf and its supporting angles then can be connected to the swing plate and the whole structure removed in one piece after the vessel is

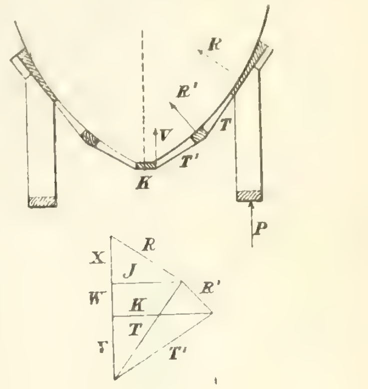


FIG. 18.

afloat. This change affects the transmission of the thrust P of the poppets to to the hull, as shown by the triangle of forces in Fig. 17. The pressure R and the tangential force T remain as before, but the latter is now up by the swing plate, and its vertical component V is transmitted to the keel. The ship is now supported on each side by X, the vertical component of R acting at the top of the poppets, and by V, the vertical component of T acting at the keel. The horizontal component of R now acts compressively upon the ship's structure, and any internal shoring should be in the direction of R.

If the cross-section of the hull is of rounder form than indicated in the preceding figures, it may be necessary to bend the swing plate and introduce additional packing at the change of direction. The vessel is now supported at three points on each side, by the vertical components of R, R', and T', and

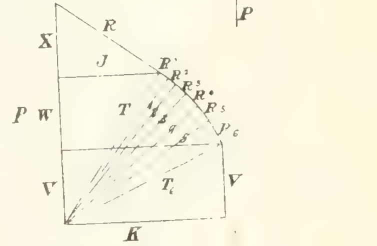


FIG. 19.

the diagram of forces becomes more complicated, as shown in Fig. 18.

In the limit, the swing plate may be, as it were, wrapped round the whole of the section and closely packed, the only straight portions being those in way of

the poppets and under the keel. The diagram of forces, Fig. 19, shows P, R, and T as before. To find the hull pressure and tension of the swing plate at various points, divide the curved portion of the plate into a number of equal parts, and from the lowest point of the triangle of forces draw radial lines parallel to the mean slope of each (approximately straight) intercept. From the right-hand corner of the triangle drop a perpendicular upon the radial line T, and from its foot drop a perpendicular upon the radial T_2, and so on. The lengths so cut off from the radials give the varying values of the tensions in the swing plate, while the lengths of the various perpendiculars represent for each portion the total pressure normal to the hull. The total upward force P is then transmitted to the hull in three portions: X the vertical component of R, W the total vertical component of all the pressures transmitted for the curved portion of the swing plate, and V the upward thrust on the keel, and the internal

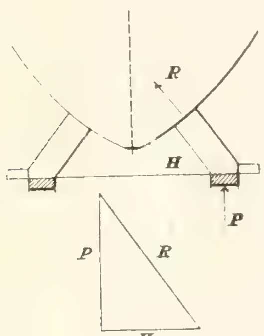


FIG. 20.

shoring should be arranged to take up these several portions of the total support.

Poppets Placed Normally to Hull Surface

Consider next the case of poppets placed normally, to the hull surface, with a cross tie-plate to prevent their lower ends sliding apart. The triangle of forces will be as shown on Fig. 20, and it is at once evident that the normal pressure R upon the hull is much greater than before for any given value of P. The horizontal components of R, each equal to H, will tend to compress the hull transversely. The internal shoring should lie in the direction of R.

To give the lower surface of the poppets a grip on the tie-plate H, a shelf supported by closely spaced angles may be employed, the construction being similar to that already shown for the shelf at the heads of vertical poppets. The portion of the tie-plate which extends beyond the shelf plate must be supported by the wedges to prevent it from bending downwards when loaded. It is advisable to have this extension as short as possible, and this may render it difficult to obtain sufficient rivet area. In a recent case this was got over by fitting some of the supporting angles below the tie-plate and some above, thus putting the rivets into double sheer as shown in Fig. 21.

Rarely Necessary to Slope Poppets

It is seldom or never necessary to slope the poppets to so great an angle as would make them stand normally to the hull surface, though some slope is inevitable in the case of vessels which are very fine forward if great length of poppet of wide shelf is to be avoided. The usual condition is therefore that of a strut inclined both to hull and to

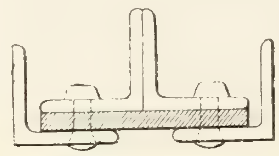


FIG. 21.

ways and requiring shelf plates both at head and at heel. In the simplest case —that of an all-straight swing plate— the triangle of forces will be as shown in Fig. 22, J representing the transverse compressive force upon the hull.

Other cases in which swing plates and diagonal poppets are combined may be treated similarly in the manner already explained when dealing with vertical poppets.

A more complicated case is that in which the whole swing plate is curved except in way of poppets and keel, and in which the lower tie-plate has to be sloped downwards to pass under the keel (Fig. 23). In which case the shaded block, consisting of sliding-way and wedging, divides the upward force P into a pressure S normal to the tie-plate and a frictional force F along its entire surface. These three forces hold the block in equilibrium. The pressure S in turn is split up into a thrust Q along the poppets and a thrust G upon the shelf plate. The tension H is the sum of the frictional force F and the thrust G, all as shown on the diagram of forces. The vessel is supported on each side by four forces; the vertical component X of the pressure R between the poppets and the hull, the sum W of the vertical components of all the pressures R supplied by the curved portions of the swing plate, the vertical thrust V coming from the swing plate at the middle line, and another vertical thrust Z supplied by the tie-plate where it passes under the keel.

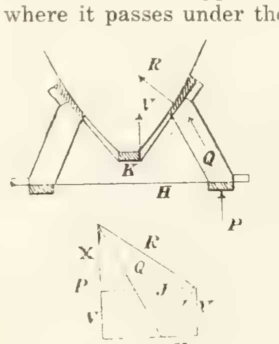


FIG. 22.

The total transverse compression on the hull is C, equal to the sum of the tensions in the horizontal portions of the tie-plates where they cross the middle line.

This type of cradle has now been used for the last twelve large vessels, and in no case has there been any difficulty or damage.

For smaller vessels where the loads on the fore poppets are not too great, the swing and tie-plate may be replaced by chains or wire ropes wrapped round the poppets and tightened by screws or wedging.

COLORED SEA WAVES

THE blueness of sea-water depends greatly on its saltness. In the tropics the tremendous evaporation induced by the blazing sun causes the water to be much salter than it is in higher latitudes. For about 30 deg. north and south of the equator the waters are of an exquisite azure. Beyond these latitudes the blue changes to green, and in the Arctic and Antarctic Oceans the greens are almost as vivid as the tropical blues.

The extraordinary blueness of the

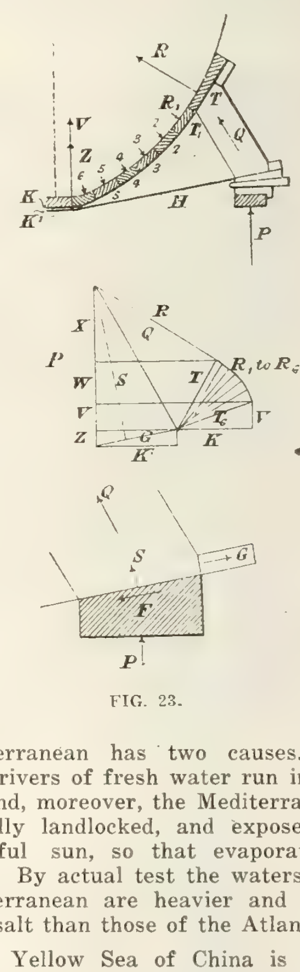


FIG. 23.

Mediterranean has two causes. Few large rivers of fresh water run into this sea, and, moreover, the Mediterranean is virtually landlocked, and exposed to a powerful sun, so that evaporation is rapid. By actual test the waters of the Mediterranean are heavier and contain more salt than those of the Atlantic.

The Yellow Sea of China is usually supposed to owe its color to the flood of muddy water that its great river pours into it. Living organisms are responsible for the peculiar tint.

Occasionally, for some cause yet undiscovered, great areas of the ocean turn milk-white. In March, 1904, a Japanese merchant vessel, steaming at night between Hong-Kong and Yokohama, ran into a snow-white sea. It was an expanse of pure snow-white that dazzled the eyes. The phenomenon lasted for six hours.

CANADIAN MARINE "HEADLIGHTS"

ROY MITCHELL WOLVIN, president, the Standard Shipping Co., handling transportation on Great Lakes, also marine insurance, Grain Exchange, Winnipeg, Man.; president, Canada West Coast Navigation Co.; vice-president, Collingwood Shipbuilding Co.; president, Duluth Shipping Co., Duluth, Minn.; president, Central Shipping Co., Chicago; director, Canada Steamship Lines; director, Kingston Shipbuilding Co., was born at St. Clair, Mich., January 21, 1880, son of George A. and Mary Wolvin.

ROY MITCHELL WOLVIN.

He received his education in the public schools of his native town, following which he joined the Western Transit Co., Duluth, as clerk in 1896. From 1903 until 1909 he was general manager of the Great Lakes & St. Lawrence Transportation Co.; the Peavy Steamship Co.; the Provident Steamship Co., the Acme Steamship Co.; and the Standard Steamship Co., all of Duluth. In the latter year he took up residence in Winnipeg, from which city he moved to Montreal during the present year.

Mr. Wolvin holds membership of the Winnipeg Grain Exchange; Montreal Board of Trade; Fort William Board of Trade; Duluth Board of Trade; Chicago Board of Trade; and New York Produce Exchange. His clubs include the Manitoba, St. Charles Country, and Carlton of Winnipeg; National, Toronto; Kitchi Gami, Duluth; and Montreal Canada, Montreal. He married "Geraldine Faro" of Chicago, June 14, 1916.

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Vol. VII JUNE, 1917 No. 6

PRINCIPAL CONTENTS

EMERGENCY AND PERMANENT VALUES OF WOOD AND STEEL SHIPBUILDING INDUSTRIES

IT is of peculiar interest to note that the thousand wood vessel programme of the United States Government, involving the completion of that number of 3000-ton craft in eighteen months' time, has been passed up, in other words, investigation of the available resources has demonstrated the futility of the enterprise. Major-General Goethals, director of ship construction for the United States Government, speaking at the recent dinner of the American Iron and Steel Institute, pricked the wood-ship-in-quantity bubble by remarking that "when we consider that the birds are now meeting in the trees that were to go into these ships, and that the latter must have a speed of not less than 10½ knots if they were to escape being submarined, the proposition was hopeless."

Inasmuch, however, "as every little helps" so far as "bottoms" are concerned for the meantime overseas transportation of food and army supplies, the contribution of as many wood ships as material resources and plant capacity combined can put promptly into commission is in no sense to be discouraged, at the same time, it should be fully realized that, as a permanent national asset, wood schooner construction will at best have only a sentimental value. Even the steel sailing ship or barque has practically disappeared from ocean service, its displacement by the tramp steamer being quite as complete as was that of the wood schooner when steel became the material of construction. The best and most substantial contribution that Canada and the United States can make towards the rehabilitation of the world's ocean-carrying service is that of steel built, steam propelled ships, and in their plans and arrangements to that end they will be establishing and consolidating a coterie of industries within an industry of the highest possible value, making not only for permanence, but national progress in and development of a multiplicity of arts, crafts and specialized manufactures.

In advising the American Iron and Steel Institute of the results of his investigation concerning wood shipbuilding, Major-General Goethals took occasion to point out that, as ships were urgently required, and must of necessity be of steel, the co-operation of iron and steel manufacturers was a sine qua non of production. As a result of the plea made, the resources of the United States iron and steel industries are to be mobilized and placed at his disposal, and as an earnest of successfully carrying through such an undertaking, an administrative committee has been appointed, its personnel including such steel industry giants as Judge Elbert H. Gary, James A. Farrell, Charles M. Schwab, etc.

We in Canada don't seem to be at all awake to the immense importance attaching to steel shipbuilding, else long ere this tangible evidence would have been forthcoming of both steel plant and ship plant enterprise on our ocean highways and ocean shores. That hesitancy has been displayed in embarking on a wood shipbuilding programme doubtless admits of considerable justification because of its certain fleeting existence; why, however, an equal hesitancy should be shown towards broadening the scope of present, and the initiation of new lines of industrial endeavor whose outcome would be the creation and upbuilding of a Canadian built, equipped, manned and owned, ocean as well as lake fleet, of carriers of world competitive importance, there appears no good reason.

The dual programme of wood and steel shipbuilding may have obscured the issue and complicated the situation somewhat, however, the wood construction feature as disposed of in the United States, may as likely as not allow more real concentration on that of steel, and lead even now to some worth-while developments in the latter.

Marine News From Every Source

Victoria, B.C.—A shipbuilding company has been organized here with a capital of $500,000. T. O. Cameron, of of the Cameron Lumber Co., is interested in the proposition.

Newcastle, N.B.—The International Shipbuilding Corporation which is erecting shipyards at Newcastle, N.B., has taken over the plant and business of the Sydney Foundry Co., Sydney, N.S.

St. Catharines, Ont. — The steamer Nipigon, bound up, carried away the two head gates of Lock 1, Welland Canal, on the evening of May 26, tying up navigation until the following night.

New Westminster, B.C.—It is reported that twenty-five wooden steamships will be built in British Columbia by the Imperial Munitions Board, and of this number probably eight will be built here.

The Halifax Shipbuilding Co., with a capital stock of three million dollars and head offices at Halifax, N.S., has been Federally incorporated. The provisional directors are given as members of a Halifax law firm.

Shipbuilders' Corporation Ltd., has been incorporated with a capital of $250,000 to construct ships, tugs, lighters, etc., of every description. The head office of the company is at Toronto and the incorporators are Gerard Ruel, Reginald H. M. Temple and R. G. O. Thomson all of Toronto.

Goderich Drydock & Shipbuilding Co., has been incorporated at Ottawa with a capital of $1,000,000 to carry on a shipbuilding business and make machinery appliances and engines etc., at Goderich, Ont. The incorporators are David T. Grant, Mervil Macdonald and P. E. F. Smiley, all of Toronto.

Halifax, N.S.—The Canadian steamer Premier, while coming out of Sambro, in a fog, on June 4, went ashore on Pollock Ledges, and is still hard and fast aground. The crew was taken off by steamers that went to her assistance. The vessel registered 275 tons, and was formerly owned in Toronto.

New Glasgow, N.S.—The first steamer to be built by the Nova Scotia Steel & Coal Co., will be ready to launch in three or four weeks. Work on the second steamer, which is 25 per cent. larger than the first, is well advanced, and as soon as the first is launched the keel of a third will be laid.

U.S. Steel Corp. to Build Shipyards.—The United States Steel Corporation has purchased a big acreage near Newark, in the New Jersey meadows, within a short distance of deep water, and will erect immediately a large shipyard where standard 8,000 and 10,000 ton steel ships will be constructed, probably with the co-operation of the Government Shipping Board.

South Vancouver, B.C. — Announcement was made at the meeting of the South Vancouver Board of Trade recently that a contract had been signed with the firm of Lamond & Harrison for the building of a wooden ship, 225 feet long, 44 feet wide and having a draft of 19 feet. The cost of the vessel will be approximately $225,000.

Victoria, B.C.—R. P. Butchart and Capt. Troup have arrived here from Ottawa with plans and specifications of the wooden ships that it is proposed to construct on the Coast. They will visit shipyards and possible sites for new plants. They are prepared to give contracts to builders who can demonstrate that they are in a position to fill them.

St. Catharines, Ont.—A rather rare event occurred on June 7, when the steamer Schuylkill, which for a number of years has been engaged in freight service on the Great Lakes, passed through the Welland Canal in two parts. She was cut in two sections in a Buffalo dry dock, and will again be joined in Quebec prior to going into service on the Atlantic.

Anchor, Donaldson, Ltd.—In connection with the recent formation of Anchor, Donaldson, Ltd., announced in the Lloyd's list, the Donaldson Line management explain that the new company has acquired the steamers Letitia, Saturnia, Cassandra and Athenia. Otherwise the Donaldson Line continues as before, managed by the Donaldson Brothers, Ltd., and there is no prospect of further change.

Will Omit Canadian Calls.—The White Stare Line, acording to the local agent at Port Huron, Mich., has decided to omit all landings at Canadian ports hereafter, and will confine the trips of its boats to the American side. This action has been brought about by the recent announcement that the Government will in future enforce the ruling of the Department of Commerce and Labor that all passenger steamers carrying freight instal a sprinkling system for fire protection.

Canal Traffic Light.—The statistical report of lake commerce through the canals at Sault Ste. Marie, Michigan and Ontario, for the month of May, 1917, show a large decrease over last year. This showing was due to the almost unprecedented ice conditions over the Great Lakes. The largest decrease is shown in iron ore, of which 5,436,467 tons were locked through, compared with 15,837,114 tons in May, 1916. Grain and wheat show a slight increase, all other items showing decreases.

Coal Steamer Burned.—The burning of the British steamer Njord, coal laden, was reported on June 11, when Captain Joseph Turner and the crew were landed at St. Pierre, Miq., by the British schooner E. B. Walters. The Njord was bound from Sydney, N.S., for St. John's, Nfd. She was abandoned forty miles east by north of St. Pierre de Miquelon Island.

Record Grain Cargo.—The steamer W. Grant Morden of the Canada Steamship Lines, arrived at the Government elevator, Port Colborne, Ont., on June 13, with what is conceded to be the largest grain cargo ever brought down the lakes. The cargo consisted of 750,000 bushels of oats, valued at more than $600,000. The whole was discharged in fifteen hours, and this creates a new record in handling grain. Unloading was commenced at 7 a.m., and the steamer cleared at midnight for Fort William.

New Lakes Vessel Puts to Sea—Under command of Captain Perry, of Cherbourg, France, and manned by a crew of Frenchmen and Chilians, the steamer Toulouse, just completed at the Superior Shipbuilding Co.'s yards, cleared from Duluth, Minn., on June 3, for the Atlantic, where she will be used in coasting and in the North Sea trade. The boat is 254 feet long, 48 feet beam and 24 feet deep and is built along ocean lines, with deckhouse amidships. The Orleans Railway of France is her owner.

Schooner "McClure" Torpedoed.—Private advices announce that the three-masted schooner McClure, formerly owned and sailed by Captain Isaac A. Hopkins, of Halifax, has been torpedoed in the Mediterranean. Captain Augustus Taylor and crew are safe. The McClure was sold by Captain Hopkins to G. A. Taylor, of St. John's, Nfld., and Capt. Taylor and crew came to Halifax last winter and took the vessel to St. John's with a general cargo. On this trip the McClure had a cargo of fish from St. John's. She was a vessel of 191 tons register.

Lakes All Higher in May.—Each of the Great Lakes attained a higher level in May than in April, and with the exception of Lake Ontario, each was above the average for the month in the past ten years, according to the monthly report issued by the United States Lake Survey

Office at Detroit, Mich., on June 7. The stages of each of the lakes in feet above mean sea level in May, as compared with April, were:—

	April.	May.
Superior	602.28	602.38
Michigan-Huron ..	580.78	581.14
St. Clair	575.21	576.07
Erie	572.57	572.93
Ontario	246.24	246.51

Reason for Lessened Shipping Losses.—The Parliamentary correspondent of the London Chronicle says that the optimism created by the marked diminution in our shipping losses in the past weeks is not shared in informed circles. It is true that greater success is being achieved with our anti-submarine devices, but the falling off in the sinkings disclosed in our recent official returns is chiefly due to the fact that fewer U-boats were operating during this period as many have gone home to refit. This was admittedly the surmise, and its correctness is proved by the fact that our most recent losses are decidedly heavier than the averages for the previous four weeks.

Big Shipping Profits.—The report of the Oceanic Navigation Co., White Star, for last year, shows a profit of £2,402,-758 after providing for excess profits taxation. The profit represents an increase of £434,473 over 1915, which is more than double that of 1914. Dividends of £750,000, equivalent to 20 per cent., have been paid, leaving a balance of £300,636 to be carried forward, compared with £156,768 in 1915. Dividends of 35 and 30 per cent. were paid in the previous year. Last August the capital of the company was increased by £750,-000.

Schooner Foundered.—The schooner "Fabola," Capt. Ulric Gagne, loaded with provisions, which were valued at $7,000 and other cargo estimated to cost about $3,000 sank with her complete cargo at Penticost on the morning of June 6, without loss of life. The schooner in a strong gale crashed into the wharf at which she was to moor and foundered in a short time before any of the cargo could be discharged. It is understood that neither the cargo nor vessel was insured. The schooner was owned by Capt. Gagne, while the provisions were consigned to Chas. Pacquet, merchant of Penticost, who stands to lose about $7,000. The Fabola left Quebec about a week before.

Winter Port Business at St. John, N.B.—During the winter season just ended the exports handled by the C.P.R. at West St. John aggregated a total of 1,111,957 tons, an increase of 200,582 tons over the previous winter's total. The C.P.R. grain shipments for the winter were 9,000,000 bushels in round numbers; last year they were 13,000,000 bushels. The total of imports handled by the C.P.R. in 1916-17 amounted to 84,629 tons, an increase over last year of 19,312 tons. In addition to the traffic above mentioned, there were large shipments of exports and imports on the East Side which will swell the total of the port's business up to a very large amount. It is estimated that slightly over $1,000.000 were paid out in wage of checkers and longshoremen during the winter.

Reid Wrecking Co. Sold.—The business of the Reid Wrecking Co., with its fleet of tugs and wrecking apparatus, has been sold to the Reid Towing & Wrecking Co., a corporation headed by Roy Wolvin, of Duluth, according to a statement given out on June 1, by Captain J. T. Reid. Mr. Reid and his brother, Wm. H. Reid, are associated with the new company. It is expected that J. T. Reid will be manager. The Reid drydock at Port Huron is not included in the transaction, but will continue under the present management. The tugs transferred are the S. M. Fischer, James Reid, Sarnia City, Smith, Diver and Manistique. It is probable that the Port Huron and Sarnia offices will be continued as at present.

Tusket, N.S.—The Tusket Shipbuilding Co., Tusket, N.S., expect to lay the keel of their first ship some time in July, as the moulds are being made and the company's timberman is now at work acquiring timber. It is intended to build 4-masters of about 500 or 600 tons, with auxiliary engine space. The vessels will be standardized as far as possible to facilitate and expedite construction. Robie McLeod of Liverpool, N.S., who has built some 70 wood sailing craft during the past 30 years will be master shipbuilder. It is proposed to have two shifts at work in the period from dawn to dusk, in which case from 30 to 40 hands will be employed. All communications relating to the enterprise should meantime be addressed to Louis N. Fuller, 163 Hollis Street, Halifax, N.S.

Steam Barge Burned.—The steam barge Sand King, owned by W. Fraser, of Montreal, and in charge of H. F. Cumming, of Cornwall, was badly damaged in the St. Regis river near the Indian village of St. Regis, on the morning of June 1, by a fire which broke out near the boiler room. The Sand King was anchored in the river the night previous, preparatory to commencing loading operations the following morning. On the boat, besides Mr. Cumming, were Louis Hence, of Summertown, the mate, and Frank Garvin, of Farran's Point, engineer. The cabin and sleeping quarters, cooking utensils, shovels, and everything about the deck, were completely destroyed. The boat was beached in five feet of water, which saved the greater part of the hull. The loss is partially covered by insurance. Mr. Hence had his hands badly burned and Mr. Cumming also had one hand slightly burned.

Wooden Ships for B.C.—The following is a description of the vessels that will be built in British Columbia, in an official statement issued by the Imperial Munitions Board's representatives: 250 feet long, 43 feet 6 inches beam and 25 feet deep, with a dead weight capacity of about 2,800 tons on a draft of 21 feet. The vessels are to be built very strongly with box girder keelsons. They have a deep tank forward for water ballast. They are to be propelled by steam with triple-expansion engines of about 950 indicated horse-power. The matter of geared turbines from England is being considered for some of the ships. The vessels are to be built of Douglas fir to Lloyd's requirements for A1 classification. The system under which these vessels are to be built is as follows: The builder provides the shipyard and equipment; the board supplies standard plans and specifications, provides for a supply of all materials and for the machinery, and pays the contractor a stated margin of profit over actual cost of building with a uniform scale of wages.

Steel for Shipbuilding.—In the United States steel trade the time is believed not far distant when the public will realize that tremendous efforts are being centred on the output of material for ships. The Sparrow's Point plant of the Bethlehem organization is understood to be concentrating on ship steel to the exclusion of much structural goods. Its own shipyard will absorb a great deal of the supplies fabricated on the spot, but it is probable that other yards will draw upon the product of the mills, too. Three million tons of shipping included in the Shipping Board's plan will require approximately 1,000,000 tons of plates, shapes, etc. In view of the fact that the country's capacity for rolling and fabricating steel is in the neighborhood of 35,-000,000 tons per year, the Government program would require no more than five or six weeks for the steel to be produced if all factors were co-ordinated on the task. This is from the theoretical point of view. The full capacity of the plants naturally could not be completely centred upon the task, for the steel trade as a whole would be badly disorganized. But steel makers, it is known, are speeding up the output of Government ship material, and deliveries are looked for as rapidly as the ship-builders can handle the steel.

B.C. to Supply Machinery for Wooden Ships.—At the meeting of the B. C. Metal Trades Association held recently in the offices of the association in the Pacific Building for the purpose of meeting Messrs. Butchart and Troup, who are representing the Munitions Board in connection with the placing of orders for wooden steamers, Capt Troup explained the proposed programme of the board and what machinery and equipment would be installed in the vessels. G. G. Bushby, manager of B. C. Marine, Limited, and Knox Walkem, president of the Vancouver Machinery Depot, addressed the two representatives of the Munitions Board and pointed out to them that the association represented 95 per cent. of the engineering and machinery plants of British Columbia and that the present plants could build the engines and machinery required for the vessels and if the necessary raw materials could be provided, the boilers also. Mr. Butchare stated that all orders for machinery and engineering work would be placed locally, provided the work could be handled.

The policy as outlined by Messrs. Butchart and Troup was heartily approved by the meeting and a committee consisting of Messrs. G. Giles, Vancouver Engineering Works; H. Schaake of the Schaake Company and W. T. Fraser of the Vancouver Machinery Depot with Mr. Bushby as an ex-officio member, was appointed to co-operate with the representatives of the Board.

TABLE A.

—	A[1].	A[2].	A[3].
	ft. in.	ft. in.	ft. in.
Length B.P.	452 0	481 0	391 0
Breadth, extreme	56 6	55 5	48 2
Trial draught	27 8	27 5½	20 8
Block coefficient	0.778	0.730	0.678
Coefficient of ⊠	0.98	0.974	0.965
Displacement, tons	15,540	15,190	7.500
Speed required	12 knots	—	—
Corresponding speed to A[1] by ratio of $\sqrt{L}$	—	12.38	11.16
Speed ratio on corresponding speeds $\frac{V}{\sqrt{L}}$	0.565	0.656	0.565
Standard block 1,060 − $\frac{V}{\sqrt{L} \times 2}$ at corresponding speeds	0.778	0.778	0.778
Admiralty coefficient obtained on trial at corresponding speeds	—	308	304
Relative fineness of block to standard block	unaltered	6.2 per cent. finer	12.8 per cent. finer
Admiralty coefficient increased by 1 per cent. for each 3 per cent. of relative fineness (Table C)	—	2¼ per cent. = 6	4.3 per cent. = 13
Admiralty coefficient adjusted for relative fineness	—	314	317
Admiralty coefficient for A[1] ship, being mean of A[2] and A[3]	315.5		
Corresponding i.h.p. $\frac{D^{\frac{2}{3}} \times V^3}{C}$	3,400		
Margin on power for contingencies, 5 per cent. ..	170		
Total i.h.p.	3,570		

TABLE B.—SHOWING ESTIMATE OF POWER REQUIRED FOR A VESSEL WITH A CRUISER STERN.

—	Proposed S.S.	Basis Vessels with Cruiser Sterns.	
	A[1].	A[2].	A[3].
	ft. in.	ft. in.	ft. in.
Length, B.P.	530 0	580 0	306 0
Length on load-water line ..	550 0	600 0	317.6
Breadth, extreme	66 0	72 0	42 0
Trial draught, B.K.	27 0	28 5	15 0
Block coefficient	0.650	0.628	0.547
Coefficient of ⊠	0.96	0.95	0.926
Displacement, tons	18,080	21,920	3,118
Speed required on trial ..	17 knots	—	—
Corresponding speed to A[1] by ratio of $\sqrt{L}$	—	17.757	12.916
Speed ratio at corresponding speed $\frac{V}{\sqrt{L}}$	0.725	0.725	0.725
Standard block 1.060 − $\frac{V}{\sqrt{L} \times 2}$ at corresponding speeds	0.697	0.697	0.697
Admiralty coefficient obtained on trial trip at corresponding speeds ..	—	345	309
Relative fineness of block coefficient to standard coefficient	* 6 per cent. finer	9 per cent. finer	21 per cent. finer
Admiralty coefficient increased by 1 per cent. for each 3 per cent. of relative fineness (Table C)	2 per cent.	3 per cent. = 10	7 per cent. = 21
Admiralty coefficient adjusted for relative fineness	—	355	330
Admiralty coefficient for A[1] ship, being mean of A[2] and A[3]	343		
Add one-third of the relative fineness = 2 per cent. of the Admiralty coefficient..	7*		
Admiralty coefficient ..	350		
Corresponding i.h.p. $\frac{D^{\frac{2}{3}} \times V^3}{C}$	9,670		
Margin on power for contingencies, 5 per cent. ..	480		
Total i.h.p.	10,150		

* In this instance the block of the proposed vessel A[1] is 6 per cent. finer than the standard block, as economy of power was of more importance than deadweight. Credit for this is given, as noted above, when adjusting the Admiralty coefficient.

Victoria, B.C.—One of the first of the prospective shipbuilding corporations accepted by the Imperial Munitions Board to start a shipbuilding plant at Victoria for the construction of ships under the government scheme as previously intimated, is the Foundation Co., a powerful concern backed by Eastern capital. The Foundation Co. has been awarded a number of contracts for wooden vessels of the steam-propelled type and a suitable site has been secured for the immediate launching of the undertaking. The new shipbuilding yard will be established on the old Songhees Indian Reserve. The property has been leased to the new company by the Provincial Government through the medium of the Imperial Munitions Board at a nominal rental.

METHOD OF FINDING THE I.H.P. OF STEAMSHIPS*

By E. W. De Rusett.

THE object of this paper is to suggest a ready means of estimating the power required for the propulsion of steamers which the writer initiated some years ago and has since developed. It will be observed that the calculations circle around a standard block coefficient which is based on the speed and length of the vessel. The power of the proposed vessel is arrived at by direct reference to the trial trip records of vessels of a similar character. The inquiry embraces the following rules:—

1—For basis purposes select the trial trip records of two suitable vessels, A[2] and A[3], preferably of similar design to the proposed steamer A[1].

2—Find the speeds of A[2] and A[3] which correspond to the specified speed of A[1] by the ratio of $\sqrt{L}$.

3—Obtain the speed ratio at the corresponding speeds.

4—At the corresponding speeds measure the Admiralty coefficient from the coefficient curves of A[2] and A[3].

5—Find the standard block coefficient for vessel A[1], A[2] and A[3] by the following formula $C = \frac{V}{\sqrt{L} \times 2}$, where C is a constant 1,060, V and L being the speed and length respectively. Compare the block coefficient of these two vessels with the standard block.

6—When the relative fineness or fullness of the ordinary and standard blocks has been found, correct the Admiralty coefficients at the corresponding speed ratios.

7—Of course it is prudent to have a margin of power for contingencies, and on this account it is suggested that an addition be made of 5 per cent. if the basis ships have been tried on the Skelmorlie mile, or 3 per cent. if they have been tried on the Whitley mile—the conditions being normal.

We will now refer to Tables A and B, which show the method of applying the foregoing rules. Column A[1] contains the particulars of an ordinary commercial vessel, the power for which has to be ascertained. Columns A[2] and A[3] contain the particulars of vessels which have been tried on the measured mile.

With the object of arriving at the effect of fineness of a model on the Admiralty coefficient, the writer has prepared the following Table C, with the kind assistance of H. Bocler. It is built up from the valuable paper read by Mr. Baber at the Institution of Naval Architects in 1914.

*From a paper read at the North-East Coast Institution of Engineers and Shipbuilders, April, 1917.

It should be stated that the three models were for vessels each 400 ft. long by 52.25 ft. beam, and 23.25 draught, midship section coefficient 0.98; the displacements being for model 56a, 9,396 tons; model 30b, 10,310 tons; and 86c, 11,244 tons; the block coefficients being respectively 0.677, 0.743 and 0.812. The parallel middle bodies varied in length from 42 ft. to 200 ft. It will be noticed when the basis model 30b was fined to the extent of 8.8 per cent., the displacement reduced by 914 tons, and propelled at speeds 8, 9 and 10 knots (speed ratios 0.40 to 0.50), that the Admiralty coefficient was only raised on an average of 2.52 per cent., or one-third of the percentage that the model was fined.

When steaming under the same conditions at 11, 12 and 13 knots (speed ratio 0.55 to 0.65) the average Admiralty coefficient then rose by 5.4 per cent. above the basis model 30b, or about one-half of the percentage by which the model was made finer, and it was not until the speed of model 30b had been increased to 14 and 14½ knots (speed ratio 0.70 to 0.725) that the increase in the Admiralty coefficient was very pronounced, the average having risen to 17 per cent. above model 30b. When the basis model was filled out 9.3 per cent. and displacement increased by 934 tons, the effect on the coefficient was very apparent, it being reduced by a greater degree than had been gained by fining the model.

TABLE C.—EFFECT OF THE ADMIRALTY CO-EFFICIENTS ON MODELS OF VARYING DEGREES OF FINENESS.

Models.	Speed.		Block.		$\frac{D^{\frac{2}{3}} \times V^3}{\text{I.H.P.}}$	Admiralty Coefficient. In per cent. to Basis Coefficient.	I.H.P. at 50 per cent. Propelling Efficiency.
	Knots.	Speed Ratios $\frac{V}{\sqrt{L}}$	–	Per cent. to Basis Model.			
56a	8	0.40	0.677	8.8 per cent. finer	328	2.44 per cent. higher	695
30b	8	0.40	0.743	Basis ..	320	Basis ..	760
86c	8	0.40	0.812	9.3 per cent. fuller	279	12.8 per cent. lower	920
56a	9	0.45	0.677	8.8 per cent. finer	330	2.42 per cent. higher	980
30b	9	0.45	0.743	Basis ..	322	Basis ..	1,075
86c	9	0.45	0.812	9.3 per cent. fuller	276	14.2 per cent. lower	1,320
56a	10	0.50	0.677	8.8 per cent. finer	327	2.7 per cent. higher	1,360
30b	10	0.50	0.743	Basis ..	318	Basis ..	1,490
86c	10	0.50	0.812	9.3 per cent. fuller	264	15.4 per cent. lower	1,850
56a	11	0.55	0.677	8.8 per cent. finer	323	6.2 per cent. higher	1,835
30b	11	0.55	0.743	Basis ..	304	Basis ..	2,060
86c	11	0.55	0.812	9.3 per cent. fuller	265	12.8 per cent. lower	2,515
56a	12	0.60	0.677	8.8 per cent. finer	314	4.7 per cent. higher	2,450
30b	12	0.60	0.743	Basis ..	300	Basis ..	2,720
86c	12	0.60	0.812	9.3 per cent. fuller	251	16.3 per cent. lower	3,430
56a	13	0.65	0.677	8.8 per cent. finer	313	4.7½ per cent. higher	3,120
30b	13	0.65	0.743	Basis ..	299	Basis ..	3.470
56a	14	0.70	0.677	8.8 per cent. finer	313	11.8 per cent. higher	3,900
30b	14	0.70	0.743	Basis ..	280	Basis ..	4,600
56a	14.5	0.725	0.677	8.8 per cent. finer	312	22.4 per cent higher	4,350
30b	14.5	0.725	0.743	Basis ..	255	Basis ..	5,640

It is not intended that the standard block shall be unalterable; it is subject to amendment according to the exigencies of the case—but when any deviation occurs the percentage of relative fineness will, of course, be attended to, as illustrated in Tables A and B. It may be of interest to observe here that the block of the famous Mauretania was the same as the standard block herein referred to, when steaming at full speed on her 48 hours trial.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

William Dott, Liverpool, manager for the Allan Line Steamship Co., died there on June 2.

Capt. Joseph A. Tymon, one of the best known of inland water sailors, and for many years commander of a Toronto Ferry Co. steamer, passed away on June 5 at his residence, 227 Logan Avenue, Toronto, aged 50.

Capt. Luke W. Bickel, one of the most successful American missionaries in Japan, is dead, aged 48. He was known as the skipper of the "gospel ship" Fukul Maru, with which he visited practically every nook and cranny of the islands of the inland sea, working in a field in which he was almost alone.

Canadian Navy League.—A Canadian Navy League, affiliated with the British Navy League, was formed on June 11 at a meeting held in the offices of the Montreal Harbor Commission. W. G. Ross, president of the Canadian branch, reported that at a meeting of the executive held on May 21, it was decided to send to the British Admiralty a further twenty thousand pounds for distribution among the institutions caring for navy men and their dependents, and also twenty thousand pounds to Sir George Perley for the sailors of the Mercantile Marine, which made in all the sum of one hundred and forty thousand pounds forwarded to England as a result of the campaign conducted throughout Canada for the above fund. It was also decided to close the British Sailors' Relief Fund and form a Canadian Navy League. The following were elected as officers of the Canadian Branch: President, W. G. Ross; hon. secretary-treasurer, M.P. Fennell, Jr.; general secretary, Lt.-Col. C. W. Williams.

James Spelman, president of the John S. Metcalf Co., grain elevator engineers and builders of Montreal, London, Chicago and Melbourne, died at his home, on Cote St. Antoine Road, Westmount, Que., on May 27. He was born at Ottawa, Ont., December 10, 1860, was educated in the Ottawa Schools and was graduated from the Royal Military College, Kingston. He was employed for some time on C.P.R. construction work in the West and later went into grain elevator building, being associated with the Metcalf Company for twenty years.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street. Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.: John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION.

President—A. A. Wright, Toronto. **Secretary**—Francis King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE.

Chairman—W. F. Herman, Cleveland, Ohio
Secretary—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

GRAND COUNCIL, N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B.; Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I. Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

He was president for the past five years. He was a member of the Engineers' Club, the Canadian Society of Civil Engineers and the Western Society of Engineers.

STORY OF THE SINKING OF THE S.S. "CAMERONIA"

A LIVERPOOL officer of the Cheshires has forwarded to the Liverpool *Journal of Commerce*, the following extremely interesting account of the sinking of the Anchor Line Steamship Cameronia recently:—

"It was all very sudden. We had no notion we were in danger of any sort until a kind of shudder ran through the ship, and she began to list heavily. It was all taken with wonderful calmness. Orders were shouted in the most matter-of-fact tone by officers of the ship and officers in charge of the troops, and everybody began to dovetail into the place assigned to him. There was not even the suggestion of panic. The men came up from below, and fell in quickly and quietly on the deck to await orders. The boats were lowered where possible, and batches of men were quickly got into them.

"The only approach to disorder was that some of the men were reluctant to move off until comrades has been got away safely. Soon the boats were full, and there was no possibility of doing anything more owing to the rapidity with which the ship was sinking. Down below the black squad were still at their post, and it was only when the captain sent definite orders that they consented to come up to take their chance of rescue. It was then a question of jumping for safety. Some were not able to do it. The last I saw of them they were huddled together on all that was left of the ship, awaiting the end. They broke into the strains of "God Save the King," and I have never felt our National Anthem so impressive as when I heard its strains steal across the devouring waters from the lips of men who were

1917 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder.	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
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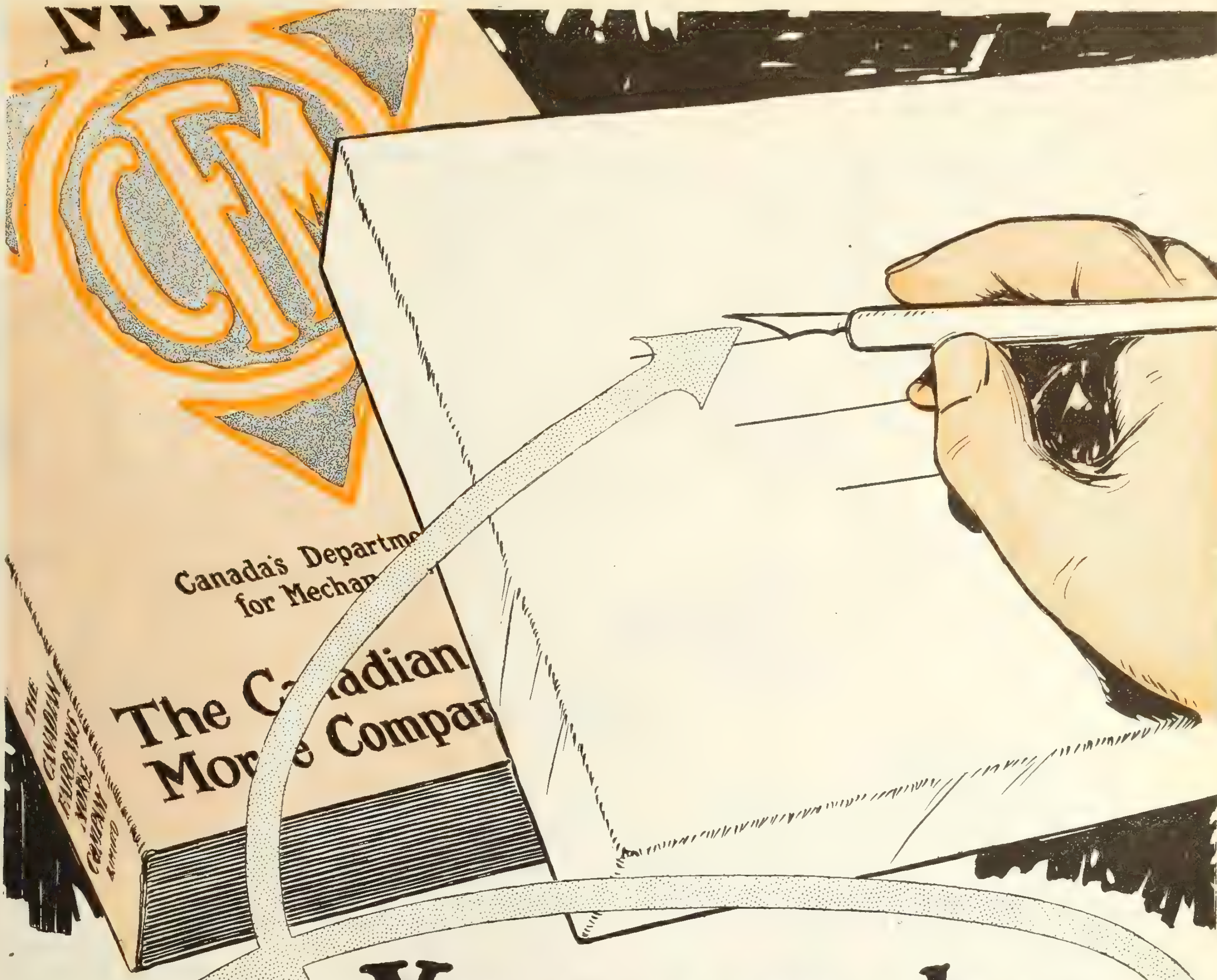
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand.	93 Fifth Avenue, Lachine. P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	176 King Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.



face to face with death, but knew no fear.

"Captain Bone was a hero. He never lost his head or displayed the slightest sign of anything unusual. He took command with the ease of the man born to the work, and issued his orders in a quiet even voice, which helped to give confidence and courage to many who might otherwise have failed in these essentials at the most critical time. All the ship's officers and crew were made in the same mould as Captain Bone. They never thought of themselves. It was always the troops they were thinking of, and not a man save those told off to take charge of the boats thought of leaving the ship until the troops had been given a fair, and more thas a fair, chance. Some of us had to try our luck in the water. I was one of them. I was picked up later by a boat from a destroyer. There were a lot of officers and men floating about. Some were unable to swim, but most managed to get hold of some wreckage to hold on to. All were merry and bright. One born optimist went past me singing "A life on the ocean wave" as he tried to keep himself afloat with the remains of a mess table."

PRINCE RUPERT DRYDOCK AND SHIPBUILDING PLANT

COMMITTEES representing the Board of Trade and City Council will confer in order to reach some plan whereby the drydock and shipbuilding plant at Prince Rupert, B.C., which has been practically idle ever since its completion about a year ago, will be started and kept going. At the meeting of the Board of Trade the whole subject was discussed at length, and there was some frank expression of opinion. It was felt that in view of so many drydocks and shipyards being worked to capacity, it was indeed strange why in the local plant there is not a wheel turning.

It was suggested that should the plant be leased, a company be formed and that nothing be left undone to keep the dock, which represents an expenditure of nearly $3,000,000, in operation. O. H. Nelson read correspondence from Sir George E. Foster and Sir Joseph W. Flavelle, Bart., chairman of the Imperial Munitions Board, which related to possible shipbuilding at Prince Rupert. Sir George took the ground that there would be difficulty in securing steel plates. He also referred to Prince Rupert's remoteness.

Sir Joseph wrote that he had conferred with a committee from Prince Rupert in Ottawa. He could say that the Munitions Board would welcome any direct proposal from any company or concern, touching the operation of the Prince Rupert plant. All possible tonnage was needed by the British Government.

At this point, David H. Hays, brother of the late Charles M. Hays, explained that George Hunter, of the shipbuilding firm of Swan, Hunter & Richardson,

Canadian Vessels, Captains and Chief Engineers

As in former years we have pleasure in recording in our columns the list of navigation season 1917 lake, river and ocean coasting vessels, together with their chief officers.

C. P. R. UPPER LAKES SERVICE, PT. McNICOLL, ONT.

Vessel	Captain	Chief Engineer
Alberta	F. J. Davis	C. Butterworth
Assiniboia	Jas. McCannel	A. Cameron
Athabasca	M. McKay	G. D. Adam
Keewatin	M. McPhee	W. Lewis
Manitoba	J. McIntyre	R. Sinclair

CANADIAN TOWING AND WRECKING CO., PORT ARTHUR, ONT.

Vessel	Captain	Chief Engineer
A. B. Conmee	W. Nuttall	Lloyd Williams
A. F. Bowman	H. Gehl	D. Moore
James Whalen	A. Morrison	H. Cross
Sarnia	A. Fader	J. Farquharson
Siskiwit	W. Garrick	W. Faloona

PROGRESSIVE STEAMBOAT CO., VANCOUVER, B.C.

Vessel	Captain	Chief Engineer
Maagen	H. Furastad	J. Harte
Progressive	A. Lewis	G. Dixon
Pronative	J. P. Tait	O. Sherberg
Projective	A. O. Clampit	O. A. Mathieson
Senator	H. Graner	B. Bond

G. T. R. DETROIT RIVER CAR FERRIES, WINDSOR.

Vessel	Captain	Chief Engineer
Detroit	F. A. Muntoon	H. Lowry
Great Western	O. Lalonde	J. Ladds
Huron	M. Bausette	A. Cook
Lansdowne	H. Oldenberg	W. Belsom
Transfer	G. Honner	W. Taylor
Transport	W. Norvell	F. Robinson

BRITISH YUKON NAVIGATION CO., WHITE HORSE, YUKON

Vessel	Captain	Chief Engineer
Canadian	J. P. Douglas	J. P. Bourne
Casca	J. O. Williams	R. C. Haws
Dawson	C. J. Bloomquist	J. R. Young
Scotia	J. McDonald	D. Sullivan
Selkirk	G. H. McMaster	W. C. Vey
Tutshi	J. G. Roberts	Jas. Lauderdale
White Horse	W. Turnbull	P. Larssen

IMPERIAL OIL CO., SARNIA, ONT.

Vessel	Captain	Chief Engineer
Imperial	H. C. Minns	G. E. Down
Imperoyal	J. Wilkie	J. Smith
Iocolite	R. Black	A. R. Fleming
Iocoma	G. T. Cross	C. Arnberg
Royalite	N. McL. Scott	J. F. A. Prysz
Sarnolite	R. T. Junes	J. Spencer

MATTHEWS STEAMSHIP CO., TORONTO.

Vessel	Captain	Chief Engineer
Easton	D. N. Laroche	J. T. Myler
Edmonton	C. R. Albinson	F. A. Pringle
Malton	D. A. Kennedy	G. H. Finn
Masaba	J. A. Smith	W. Whipps
Riverton		J. G. Fisher
Steelton	W. J. Kirkwood	J. A. McGill
Yorkton	R. Alexander	D. McKenzie

HUGH CANN AND SONS, YARMOUTH, N.S.

Vessel	Captain	Chief Engineer
Bruce Cann	I. A. Banks	H. Goodwin
Hugh D.	E. Smith	H. Doane
John L. Cann	A. L. McKinnon	J. Nixon
Latour	F. E. Smith	C. R. Weddleton
Mary H. Cann	F. L. Nickerson	W. Amiro
Percy Cann	J. R. Durkee	D. E. Read
Robert G. Cann	W. E. Morris	B. Lumsden
Wanda	U. J. d'Entremont	A. Rogers

OTTAWA TRANSPORTATION CO., OTTAWA, ONT.

Vessel	Captain	Chief Engineer
Dolphin	Z. Lavigne	D. Moranville
Florence	E. Lefebvre	A. Madore
Glen Allan	A. Clark	E. Duracher
Hall	J. C. Barclay	John Drury
Ottawan	A. Mallette	N. Lavigne
Scotsman	E. Francoeur	V. Lavigne
Sir Hector	W. Mainville	James Schyrer

REID NEWFOUNDLAND CO., ST. JOHN'S, NFLD.

Vessel	Captain	Chief Engineer
Argyle	W. Norman	G. Pike
Clyde	J. Knee	J. Pollock
Dundee	D. Blandford	J. Cunningham
Ethie	J. Goobie	P. Burton
Glencoe	A. Blandford	F. Barnes
Home	H. Harbin	J. Pike
Kyle	L. Stevenson	J. McFailanc
Meigle	W. Parsons	J. McFailane
Sagona	G. Spracklin	J. Buckingham

CANADA SHIPPING CO., MONTREAL.

Vessel	Captain	Chief Engineer
Cabotia	R. Laing	J. R. Ferguson
Compton	B. Bowen	L. Smith
Florence	V. Gendron	S. Legendre
J. H. Hackett	J. Thibault	A. Legendre
James W. Pollette	C. A. Mahoney	M. J. McFaul
John B. Ketchum II.	W. J. Jewitt	J. Walker
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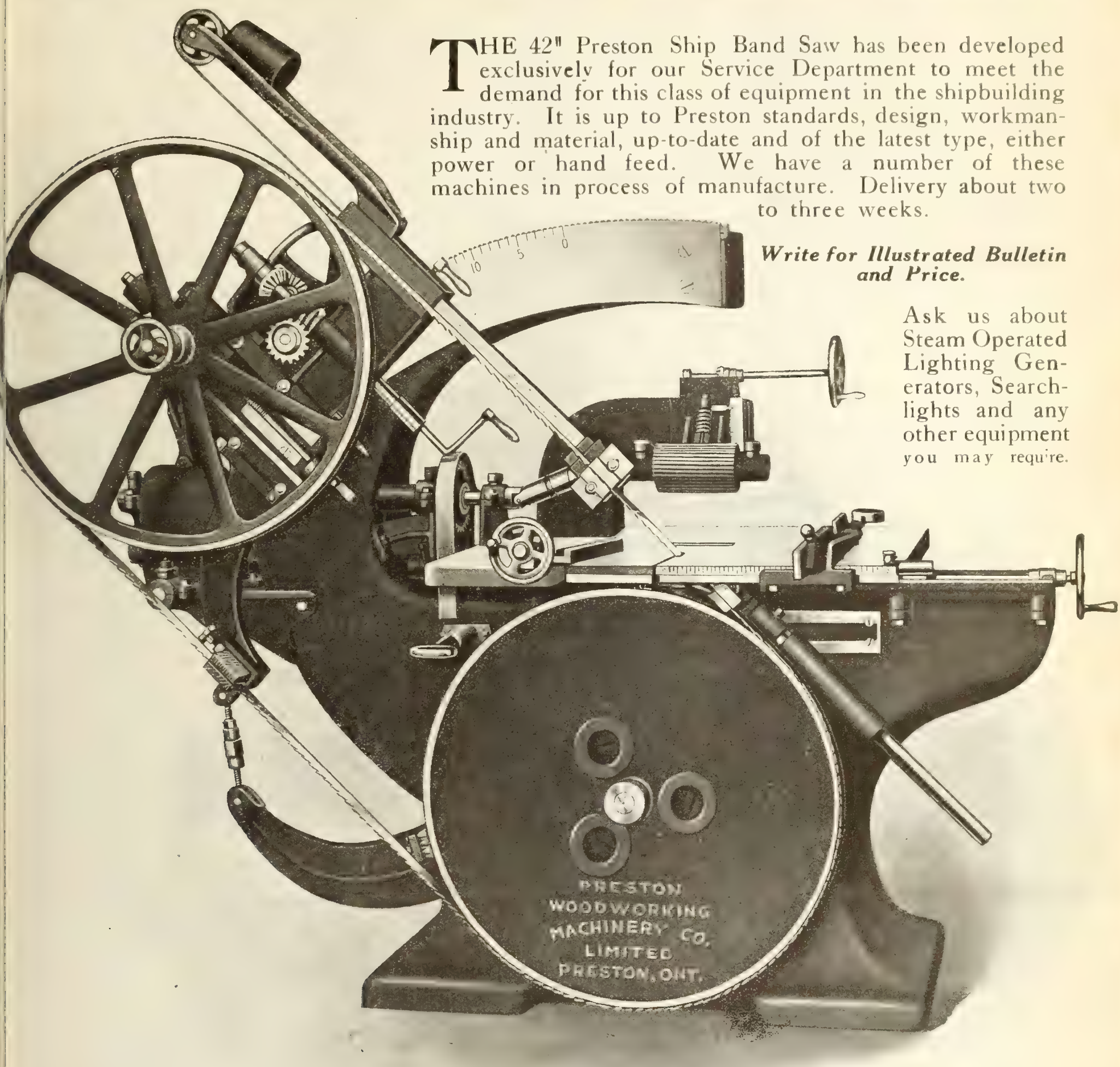

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The A. R. Williams Machinery Co., Ltd.

TORONTO

UNION STEAMSHIP CO. OF BRITISH COLUMBIA, VANCOUVER, B.C.

Vessel	Captain	Chief Engineer
Camosun	J. A. Browne	A. Beattie
Cassiar	G. Whalen	P. J. V. Farina
Cheakamus	G. Gaisford	N. Tweedie
Chelohsin	J. F. Edwards	G. H. Foster
Comox	R. Wilson	A. T. Roy
Coquitlan	N. Gray	J. Maitland
Cowichan	C. Moody	L. P. Thomas
Venture	J. E. Noel	C. Arthur

BOWRING BROS., ST. JOHN'S, NFLD.

Vessel	Captain	Chief Engineer
Eagle	C. C. Couch	J. V. Reader
Florizel	W. J. Martin	J. Fitzgerald
Hawk	F. Smith	A. McKinlay
Portia	J. W. Kean	A. Smith
Prospero	A. Kean	J. McKinlay
Ranger	W. James	E. Perez
Terra Nova	N. J. Kennedy	A. F. Osmond
Viking	C. F. Taylor	C. N. Lewis
Zelda	W. White	W. Squires

GREAT LAKES TRANSPORTATION CO., MIDLAND, ONT.

Vessel	Captain	Chief Engineer
America	A. Monck	C. Doctrine
Breezit	W. Lenton	C. A. McWilliams
Glenfinnan	A. R. McLeod	W. J. Holmes
Glenlivet	F. Burke	G. Price
Glenlyon	A. Hudson	D. Sinclair
Glenshee	W. A. Lavigne	F. Goodwin
Mack	W. Ferguson	....
Major	S. Corson	P. Eagles
Stewart	J. G. McCarthy	Jas. Wilson

C. P. R. B. C. LAKE AND RIVER SERVICE, NELSON, B.C.

Vessel	Captain	Chief Engineer
Bonnington	A. Forslund	J. Fyfe
Hosmer	M. McKinnon	P. H. Pearse
Kokanee	W. H. Wright	J. G. Cameron
Moyie	A. J. McDonald	W. Edwards
Naramata	J. B. Weeks	W. Jacobs
Nasookin	W. Seaman	T. F. McKechnie
Sandon	M. P. Reid	D. McLeod
Sicamous	G. Robertson	D. Stephens
Slocan	W. Kirby	D. H. Biggam
Valhalla	Jas. Ferguson	T. C. I'Anson

GEO. HALL COAL CO. OF CANADA, OGDENSBURG, N.Y.

Vessel	Captain	Chief Engineer
Geo. L. Eaton	W. B. Russell	W. J. Brown
Hecla	T. Lago	....
Adrien Iselin	D. Hourigan	E. B. Barker
F. P. Jones	H. M. Russell	W. Thomson
Kendall	J. A. Woods	....
A. D. MacTier	S. V. Anderson	J. W. Estes
Fred Mercur	S. LeBeau	B. Mainwaring
L. W. Robinson	John Powers	R. J. Jardin
John Rugee	U. M. Russell	John Cline
Sherman	G. Abbott	....

MONTREAL TRANSPORTATION CO., MONTREAL.

Vessel	Captain	Chief Engineer
Advance	J. V. Norris	M. J. Sherman
Bartlet	A. Ferguson	F. Moyle
D. G. Thompson	A. Lepine	R. Hepburn
Emerson	W. Murphy	J. G. Lamoureu
F. H. Bronson	L. Mallen	J. Tuttle
Glenmount	Jas. Reoch	J. B. Lappin
Glide	N. Desgroseillier	G. W. Clark
India	A. Lepine, Jr.	F. Brian
M. P. Hall	T. Lepine	H. Paus
Mary	W. J. McKenna	P. J. McKenna
Simla	C. E. Coons	D. S. Simons
Westmount	S. Hill	F. Norris
Windsor	John Doyle	A. Dunn

CANADA STEAMSHIP LINES, MONTREAL.

Vessel	Captain	Chief Engineer
Aberdeen	E. Legault	....
America	P. H. Carnegie	....
Belleville	W. Bloomfield	John Kennedy
Bickerdike	T. H. Johnston	D. S. LaRue
Boucherville	A. Laviolette	C. Hamel
Cadillac	W. Beatty	Jas. Kettles
Calgarian	R. Pyette	A. L. Black
Cayuga	C. J. Smith	A. L. Black
Chippewa	W. Malcolm	....
City of Hamilton	O. Patenaude	W. Dungan
City of Ottawa	J. L. Baxter	G. E. Holmes
Corona	B. A. Bongard	J. Kennedy
Doric	H. J. Aitken	Jos. Aston
E. B. Osler	C. E. Robinson	W. Robertson
Emperor	J. F. Davis	G. M. Smith
Fairfax	M. Heffernan	C. LaVallee
Haddington	E. J. Shannon	C. Leriche
Hamiltonian	N. McKay	A. E. Kennedy
Ionic	O. Wing	A. E. Crosthwaite
Iroquois	J. H. Hudson	J. E. Readman
J. H. G. Hagarty	G. W. Pearson	C. Robertson
J. R. Binning	G. Irwin	....
Kingston	E. Booth	W. Chipman
Louis Philippe	H. Mandeville	A. Chayur
Macassa	J. Henderson	E. A. Prince
Magnolia	....	T. Hazlett
Martian	A. B. McIntyre	R. Foote
Midland King	P. McKay	Jas. McGregor
Midland Prince	A. E. Stinson	J. A. Pickard
Modjeska	....	A. McLaren
Montreal	F. X. LaFrance	N. Beaudoin
Pierrepoint	J. E. Ouellette	....
Quebec	J. Rinfret	J. Matte

Wallsend-on-Tyne, had been asked if there was anything to the recent rumor that the firm would take over the plant at Prince Rupert. It was a fact, said Mr. Hays, that this firm, which is one of the largest of the kind in the world, stood prepared to take over the local plant and build ships, but the Imperial Munitions Board at Ottawa did not wish them to. So nothing further in that direction developed.

VESSEL LOSSES SHOW INCREASE

THE weekly shipping report issued by the Admiralty on June 13, stated that twenty-two British merchantmen of more than 1,600 tons were sunk. Ten merchantmen of less than 1,600 tons were also sunk, together with six fishing vessels. A summary of the report follows:

"Arrivals, 2,767; sailings, 2,822.

"British merchant ships over 1,600 tons sunk by mine of submarine, including one previously, 22; under 1,600 tons, including one previously, 10.

"British merchant ships unsuccessfully attacked, including seven previously, 23.

"British fishing vessels sunk, 6."

The week's figures show a considerable increase in submarine activity as compared with recent weeks. The immediately previous statement reported a total of only twenty-three vessels sunk, against the thirty-eight now announced. The aggregate is the largest of any for a month past.

The figures of submarine sinkings began to show a falling off early in May from the heavy totals of April, when during one week, that which ended on April 22, forty vessels of more than 1,600 tons were sunk and fifteen of smaller tonnage. During the week ended May 6 the total of the larger merchantmen sent to the bottom fell to twenty-four. For each of three following weeks the total of vessels of the larger class stood at eighteen, while the number of smaller craft sunk each week was covered by single figures.

Ten Italian Ships Sunk

According to the official statement on Italian shipping losses by mine or submarine, the number of steamers sunk in the week ending June 10 was five. Five sailing vessels were also sunk in the same period.

WAR CUTS SUEZ CANAL TRAFFIC IN HALF

THE report of the Suez Canal Co., published on June 12, states that traffic in 1916 had dropped about seven and a half millon tons since 1913, but, "thanks to increases in rates, the receipts had not fallen in the same proportion. The council proposes the distribution of a dividend of ninety francs; this means 18 per cent., as the shares are 500 francs. The dividend in 1913 was 164, and in 1914 165 francs.

General shipping through the canal in 1916 was 3,110 ships of a net tonnage of nearly twelve and a half millions. The proportion which was purely com-

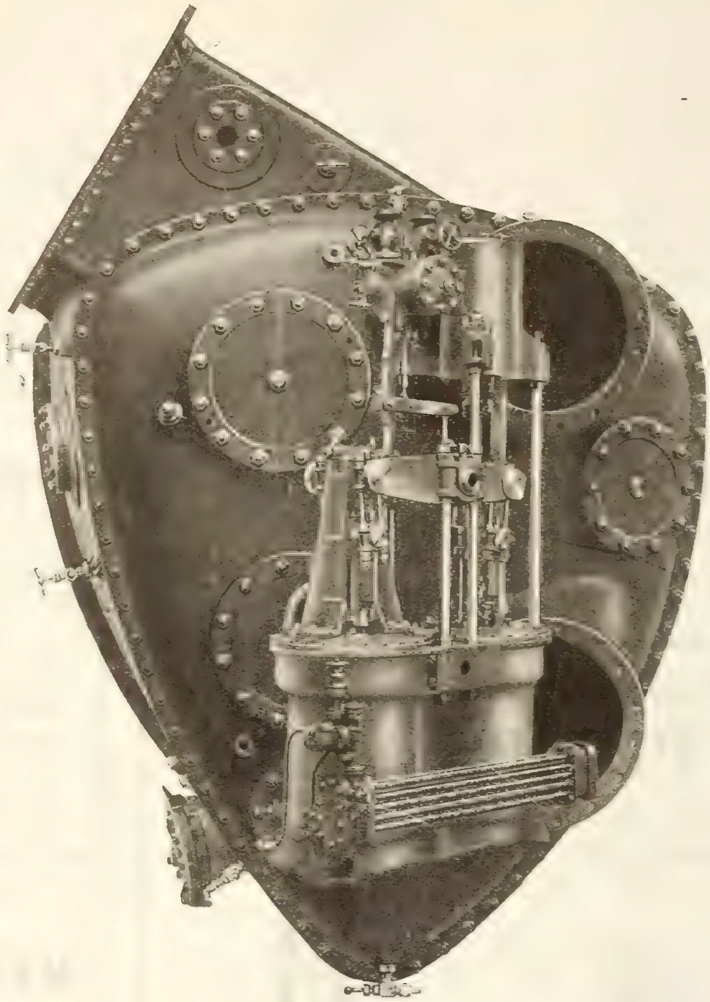
Ramona	E. M. Charlebois	....
Rapids King	....	W. Hazlett
Rapids Prince	....	G. Hazlett
Rapids Queen	....	A. Charbonneau
St. Irenee	....	O. Bonin
St. Lawrence	John Bertrand	B. Farrell
Saguenay	J. Simard	A. Godin
Sarnian	R. McIntyre	I. J. Boyton
Seguin	H. McLennan	J. B. McLaren
Sir Trevor Dawson	G. H. Page	W. W. Norcross
Stadacona	H. Hinslea	J. Grant
Syracuse	L. Legendre	....
Tadousac	W. Gagne	G. Gagnon
Thousand Islander	O. H. Kendall	....
Three Rivers	A. Mondor	....
Toronto	J. J. Jarrell	D. J. Leslie
Turbina	....	J. Gilbert
W. D. Matthews	D. W. Burke	W. Reid
W. M. Egan	N. Hudgins	J. A. Connor
W. Grant Morden	N. Campbell	R. Chalmers
Wyoming	T. B. Greenaway	....

mercial was 2,240 ships of a tonnage of eight and a half millions, the decrease being 56 per cent. compared with 1913.

The report goes on: "State commerce is taking the place of private trade, so that the decrease in commercial traffic in 1916 may therefore not be really so marked as the above figures would really lead one to suppose."

Of the 400,000 Suez shares, the British Government in 1875 bought 176,602, which in 1915 were valued at thirty million pounds, or seven and a half times the purchase price.

New Westminster, B.C.—The contract for the construction of four wooden ships at New Westminster has been let at Victoria by the British Columbia Commission of the Imperial Munitions Board. The contract for two of the vessels was let to the Westminster Marine Railway Co., a local shipbuilding concern, and the contract for the other two went to the B. C. Construction Co. It is understood that these two firms are preparing to amalgamate under the name of the B. C. Construction and Engineering Co., for the purpose of building these four vessels. Modern shipyards will be established on Poplar Island, a small island in the Fraser River, close to the city, and at the upper end of Lulu Island.



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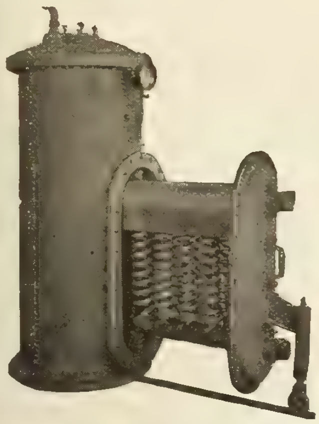
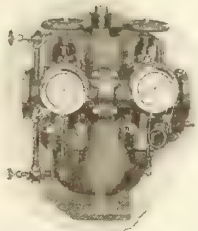
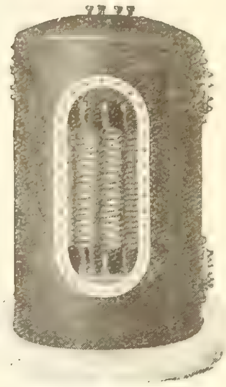


Reilly Marine Evaporator, Submerged Type

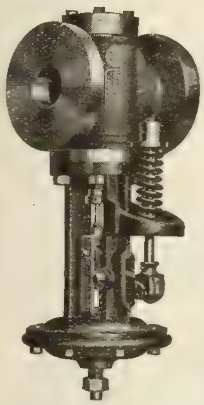


Reilly Multi-screen Feed Water Filter



Reilly Multi-coil Marine Feed Water Heater

Made in Canada by a Canadian Company



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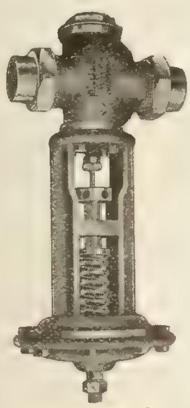

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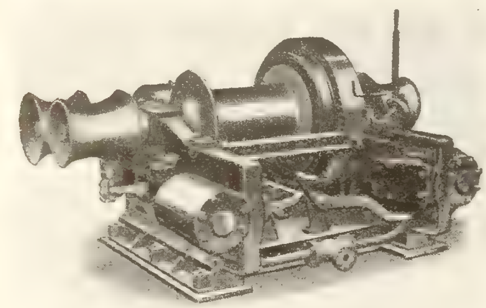

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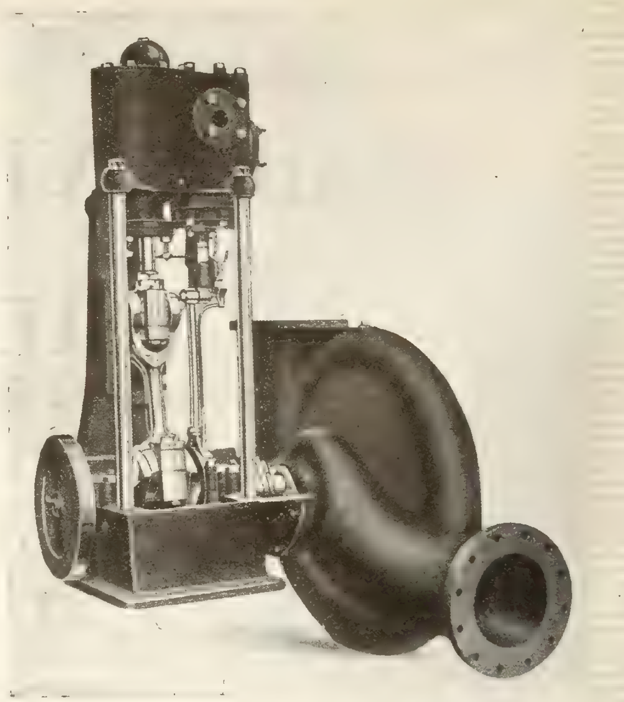

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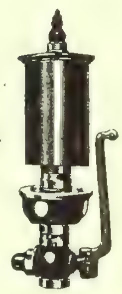

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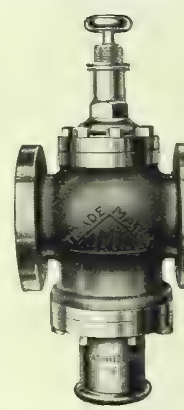

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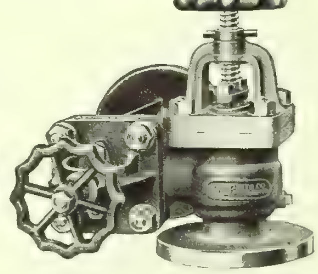

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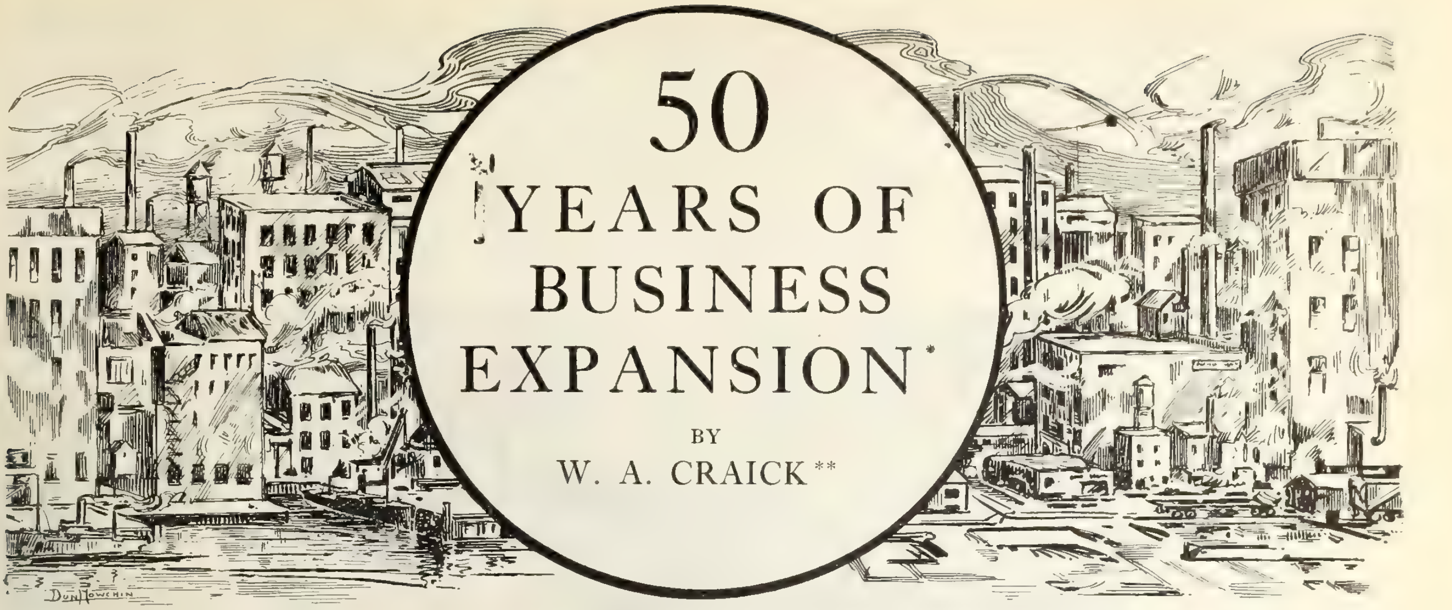


There is here given in racy fashion, yet evidencing in the variety detail discussed considerable painstaking and scrupulous regard for developments in the period under review, to the end that as far as possible everything embraced by the article title, wide in scope as it happens to be, should get at least a passing reference. Speaking generally, the advances made in the spheres of Industry, Finance, Transportation and Insurance are prominently featured.

CANADA'S position at the close of the fiftieth year of Confederation is imposing only in so far as present day conditions are placed in contrast with those prevailing at the dawn of the Confederation era. Progress is at best a relative term, and to appreciate to the full the extent of this country's development, one must visualize the setting in which that development was commenced.

To all intents and purposes, the whole of Western Canada, with its far-flung population, its many fine cities, its thousands of miles of railway and its enormous agricultural production, must be eliminated from the canvas. It is true that by 1867 some ten thousand people had settled in the Red River Valley; that stragglers had penetrated even farther west. It is also true that the gold rush of the late fifties had poured population into the Fraser River Valley and that Victoria was already a fair-sized town. But these widely-separated settlements. on the prairies and at the Coast, were almost as distant from Eastern Canada in those days as Australia is to-day, and further, their business associations were entirely with the neighboring sections of the United States.

Canada in 1867

The picture of Canada in 1867 narrows, therefore, to the comparatively restricted limits to the older settled portions of the country—the narrow fringe of clearing along the St. Lawrence; the lake front counties of Ontario; the coast and river settlements of New Brunswick and the scattered towns and fishing villages of Nova Scotia. The wider vision of a great and prosperous West had not yet seized upon the minds of the people and their field of possible endeavor lay no further off than the thickly wooded concessions of the back counties.

Though fairly well populated and supplied with the modern means of communication, the older sections of Quebec and Ontario were still in a comparatively crude and undeveloped condition. Even between Montreal and Toronto, then as now, the two foremost centres of population in Canada, the appearance of the country was anything but prepossessing. There remained much uncleared land. Many of the homes of the inhabitants were at best but miserable shanties. The people were poor; the children dirty and ragged; the cattle lean. Towns, which were quite as numerous as they are today, and in several cases nearly as large, were suffering from the after-effects of the Grand Trunk boom, and exhibited numerous unoccupied and delapidated buildings.

From Prescott to Ottawa, then the customary route to the Capital, the railway traversed what appeared to be a continuous pine swamp, wet, dismal and depressing. The Capital itself lay hidden away in the midst of green, unbroken forests, which closed in on the log houses and small villas lying on the outskirts of the embryo city.

To the rear of the counties fronting on the St. Lawrence and Lake Ontario, settlement was just getting under way at the time Confederation came into being. Railways were being promoted to tap the resources of Peterboro, Victoria, Simcoe, Grey and Bruce Counties, and settlers were arriving from the Old Country to people their solitudes. In fact, this particular section of Canada was going through an experience which has since been duplicated many times in the West.

The Government was devoting special attention to the settlement of the free grant lands in the Muskoka District. Advertising matter of the same brand as that which later lured thousands of immigrants to the prairies, told of the prospective wealth to be derived from the cultivation of the soil in this remote part of the province. In response to the appeal, population was penetrating as far north as Parry Sound on the shore of the Georgian Bay, while Bracebridge was thronged with newcomers.

Oil and Gold Booms

It was about this period, too, that the oil boom in Enniskillen Township and the gold boom at Madoc were absorbing public attention. The former attracted the curious from all parts of the country. To reach the oil fields, visitors had to leave the Sarnia branch of the Great Western at Wyoming and drive through the woods to Oil Springs. It was a trip, as described by travelers, full of spectacular interest. The great dark forest, traversed by a narrow plank road; the constant succession of carts coming and going with their barrels of oil; the derricks, oil tanks and engines scattered through the clearings, all presented a scene of strange and outlandish character. Oil Springs itself was a village of wooden hotels, thronged with speculators and hangers-on, who by their frenzied efforts to secure paying properties increased the popular interest in the district.

The Madoc gold finds were made in the year before Confederation and the rush to the mines in the spring of 1867 was one of the events of that momentous year. Prospectors in large numbers thronged to the new gold fields, from which so much was expected, and many miners, who had participated in the California and British Columbia rushes, made their way to the new Eldorado. Five lines of stages from Belleville to Madoc

*Also in MacLean's Magazine.
**Of MacLean Publishing Co. Staff.

were for a time insufficient to accommodate the crowd who sought access to the scene of the discovery.

These events, bulking largely in the popular imagination at the time, have long since dwindled into their proper proportions. The oil wells of Enniskillen have become a commonplace; the gold strikes at Madoc have sunk into insignificance. Reference has been made to them merely to illustrate how places which fifty years ago were on the very fringe of settlement and to reach which tedious journeys had to be made, are now left far in the rear by the tide of progress. The gold of Porcupine has long since eclipsed the gold of Madoc, and in Southern Alberta the oil prospector has been finding new fields for his investigations.

Lumbering

In various other respects conditions have changed in old Ontario and Quebec. Lumbering was a far more important industry fifty years ago than it is to-day. The Great Western Railway brought down from its Sarnia branch annually large quantities of oak timber. This wood was rafted at Hamilton and towed to Quebec for export to the Old Country. The Northern Railway carried to Toronto, and the Port Hope, Lindsay and Beaverton Railway hauled to Port Hope trainload after trainload of lumber for shipment by schooner across the lake. Cordwood was one of the commonest commodities of the day, and trainloads of it were a common sight on the railroads fifty years ago. It was used not only for heating and cooking, but it formed the universal fuel for locomotives, and from the back settlements thousands of cords were shipped annually to the United States.

Early City Settlements

The extent of settlement in 1867 was reflected in the cities. To-day there are in the Dominion six cities with populations in excess of 100,000 — Montreal, Toronto, Winnipeg, Ottawa, Hamilton, and Quebec—while a seventh, Vancouver, falls little short of that figure. In the year of Confederation, however, Montreal was the only urban centre that came within 50,000 of reaching the 100,000 mark. Toronto could not boast 50,000 inhabitants. Winnipeg was a mere hamlet. Ottawa contained but 15,000 people. Hamilton just exceeded 20,000 by a narrow margin. As for those flourishing Western cities—Calgary, Edmonton, Regina, Saskatoon, Brandon, Moose Jaw, and Vancouver—they were practically all non-existent. Only conservative old burgs like Quebec, Halifax, and St. John, had populations in any way commensurable with present figures.

LUMBERING ON THE UPPER OTTAWA. A FLOURISHING INDUSTRY AT THE TIME OF CONFEDERATION.

Our Capital City

The beautiful capital city of the Dominion, whose natural charms have been greatly enhanced by the work of the Ottawa Improvement Commission, has developed during the fifty years of Confederation from a crude backwoods settlement into one of the finest cities in America. So unprepossessing was its appearance when it was selected by Queen Victoria to be the seat of government, that it was described as the Cinderella of Canadian Cities. Its intrinsic beauty was recognized, but that beauty was so hidden by uncouth and dirty surroundings that the comparison was by no means inapt.

Curious visitors who went to view the new capital during the early sixties, came away with mixed impressions. It was admitted that the site of the Parliament Buildings was a lovely one; that the surrounding forests had a wild impressiveness, and that the clear air, everlasting resounding with the noise of falling water, was exhilarating, but what were these natural attractions when everyday living conditions were so bad? The streets were rough, the houses mean and squalid, the hotel accommodation wretched, and the food poor. Lumber and sawdust littered the place until it looked like one vast timber yard.

A sister of Lord Monck, who visited the town shortly before the Governor-General moved there from Quebec, groaned over the prospects of life in such a place, describing it as "t'other end of nowhere." And it is known that civil service employees, who had to forsake the comparative loveliness of Toronto, Montreal, or Quebec, for its early crudities, bemoaned their fate, while Ministers of the Crown took the earliest opportunity to escape from its impenetrable dullness.

Of course, all this has changed. Ottawa to-day boasts the possession of every modern facility, not only for the enjoyment, but for the improvement of life. Its beautiful streets and parks, its splendid public buildings, its superior hotels—all these combine to render the contrast with the miserable, down-at-the-heel settlement of fifty years ago most striking and complete.

And what of other cities? Montreal,

the foremost city of the Dominion with its more than 600,000 people could, in 1867, muster barely one-sixth of that number. In extent it was very considerably smaller. Its principal business thoroughfare of to-day, St. Catherine Street, lay on the outskirts of the city. Even lordly St. James Street, with its splendid financial institutions, was only just in course of construction. Business centred in Notre Dame Street; McGill College stood out in the suburbs, and it was a mile walk from the edge of the city to the mountain.

In several respects, Montreal, fifty years ago, was greatly inferior to the present city. Its streets were notoriously filthy, especially along the docks where the mud frequently lay knee-deep. The lighting even of the main thoroughfares was inadequate, gas being then the universal illuminant. The drainage was bad, and in this connection one visitor tells of having to leave the Theatre Royal one night in the middle of an amusing comedy on account of the vile odors that were wafted in through the windows. Apart from these deficiencies, however, the city seems to have been an imposing place with its solid-looking buildings, its many fine churches and its active commerce.

Our Queen City

Toronto's expansion during the fifty years has been equally, even if not more, phenomenal. When it is recalled that in 1867 Queen's Park, now in the heart of the city, was on its extreme northern edge, Trinity College was situated a mile beyond the western limits and that troops were able to go through extensive evolutions on a great common that lay between the city and Spadina Avenue, some faint conception of the physical growth of the place can be obtained. In population it has increased twelve-fold, or roughly from 40,000 to 480,000.

The cities in the east, Halifax and St. John, have probably exhibited fewer changes than their western sisters. Halifax, which has now about 50,000 inhabitants, had a population of 30,000 at the time of Confederation. St. John, which to-day contains approximately 54,000 people, was then a place of 35,000 inhabitants. In Halifax the lives of the citizens revolved around the garrison of British regulars which manned its forts and citadel. Some trading, it is true, went on with the West Indies. Fish was exported; sugar and other tropical products imported. But the military and naval interests of the place predominated and trade and commerce, while a necessary evil, were not allowed to thrust themselves too far into the foreground.

The commercial spirit was more in evidence in St. John, a city which then as now regarded its Nova Scotia contemporary with a feeling of suspicion and rivalry. St. John had been a notable shipbuilding centre for years and, not only was many a stout vessel built each year in its shipyards, but its merchants owned and outfitted numerous deep sea craft for service on the seven seas. The docks of St. John were a busy spot in those days, for ships and sailors were numerous and there was a constant coming and going of vessels from distant ports.

Industries Feature

If cities were small fifty years ago, so also were the industries that flourished in them. Industrially, there has been a remarkable change in Canada during the past half-century. When Confederation came into being the settled sections of the country were plentifully supplied with an immense number of small steel industries. Each town, each village, had its little group of manufacturing establishments which produced the essentials of life for the people of the immediate neighborhood. A flour and grist mill, a sawmill, a tannery, a carding and fulling mill, a carriage factory and not infrequently a brewery or distillery were the possession of practically every centre of population.

The census of 1861 showed that in Ontario alone there were in operation 501 flour and grist mills, 1,164 sawmills, 271 tanneries, 185 carriage factories, and 143 breweries and distilleries. In Ontario, Quebec, New Brunswick, Nova Scotia and Prince Edward Island combined, there were 8,503 industries, of which 1,785 were flour and grist mills, 4,240 sawmills, and 710 tanneries. By 1867 all these figures had probably been considerably increased.

Few of these primitive local industries have survived the evolution of the centralized factory system. Here and there through the country there may remain some pathetic examples of these once important institutions. But, generally speaking, the economies introduced in the operation of the large factories of to-day have made it quite impossible for the small industry to exist.

Lachine Canal an Industrial Factor

Even in the sixties there were evidences of the development of large-scale manufacturing. The building of the Lachine Canal seems to have produced a considerable industrial boom in Montreal. The canal furnished four million horsepower of hydraulic energy per annum, a huge figure for those days, and, as practically all manufacturing was done by waterpower, manufacturers naturally flocked to this new source of energy.

The extent and importance of the factories along the canal filled visitors with astonishment. There were huge iron works, employing no fewer than 120 men and producing 12 tons of nail plates per day! There was a wonderful new flour mill, which could grind 500 bbls. of flour in twenty-four hours. There was a sugar refinery with a capacity adequate to manufacture seven-eighths of the sugar consumed in Canada and there was a marine works, which could produce several ships for river and lake service each season.

One may smile at the expressions of amazement with which the citizens of 1867 regarded these examples of industrial enterprise, the size and output of which have long since been eclipsed by immensely larger establishments, but, after all, there were some industries in operation fifty years ago which would astonish even the wonder-sated folk of the twentieth century. The sawmills at Ottawa, for instance, were undoubtedly marvels. There were ten of them running night and day in an endeavor to keep pace with the efforts of the ten thousand lumbermen who were busy felling the forests along the river. One of these mills boasted eighty saws and the others were very little smaller. The ten mills together turned out 180,000,000 feet of lumber a year, while 16,000,000 cubic feet of square timber was rafted to Quebec each season for shipment across the Atlantic. In that golden age of the lumber trade, it took 800 ships, manned by 25,000 men, to carry the harvest of the Ottawa from Quebec to England.

Wood Shipbuilding

These were great and picturesque enterprises and so, too, was the wooden shipbuilding industry, which was in its heyday of prosperity when Confederation came into being. At Quebec and at many a harbor and port on the coasts of New Brunswick and Nova Scotia, fine, large wooden vessels were built and launched annually in considerable numbers. There were fifteen shipyards at Quebec alone, in which from 25 to 50 ships were turned out each year. Unfortunately, except for a forced revival of the industry at the present time, wooden shipbuilding is dead and thus an interesting chapter in Canadian industrial history is closed.

However, all industry in Canada in and about the year of Confederation was not so spectacular, though to the people of the time many of the developments seemed very wonderful. In Hamilton, for instance, where foundations for future industrial greatness were even then being laid, it was deemed a remarkable feat on the part of the local manufacturers to have installed $100,000 worth of new machinery in a single year. The production of locomotives at Kingston was considered a work little short of marvellous. The erection in Sherbrooke in 1866 of a woollen factory five stories high was heralded as a most important event, while Victor Cote's new tannery at St. Hyacinthe, which gave employment to 90 hands, was regarded as a mammoth plant.

But if industries were small and scattered, the products of industry were by no means inferior. At the great Paris Exhibition in 1867, the goods of Canadian manufacturers showed to advantage. Furniture made by Jacques and Hay in Toronto was declared to be superior to anything on display. The wall hangings of the Stauntons compared favorably with the product of the English makers. The Barbers, of Streetsville, showed cloths and woolens of most creditable quality. Implements from the Jones plant at Gananoque and the Whiting plant at Oshawa, were highly commended, as were also the cigars exhibited by Davis, of Montreal.

Transportation Developments

Industrially, Canada has traveled far since those far-away days. All the mar-

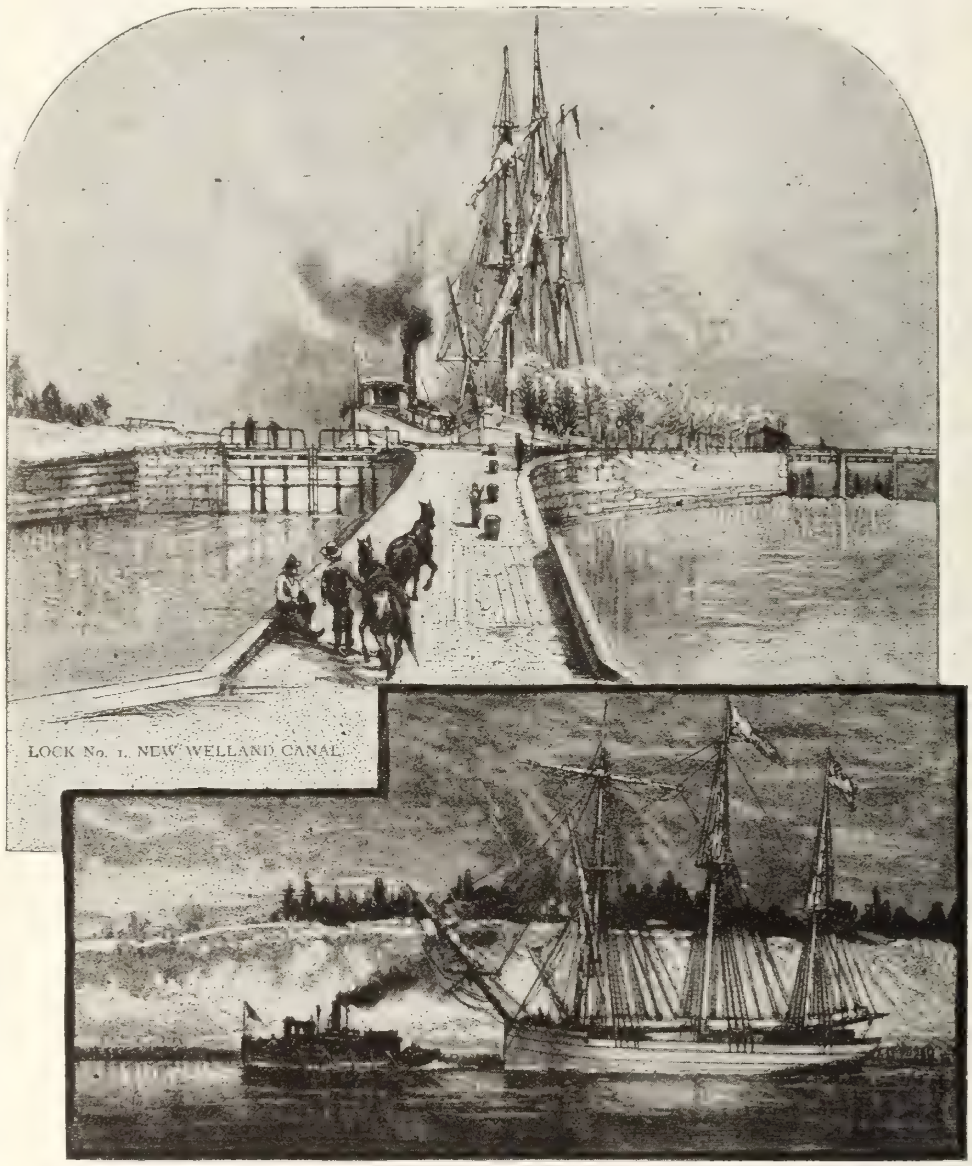
velous expansion which the introduction of electricity has facilitated has come since then. The mammoth textile works with their electric drives; the great steel plants; the huge paper mills; all these and many more have sprung into being since 1867, and in no respect has the progress of Canada been more marked than in this department of national life.

Hand in hand with the growth of industry has gone the extension of transportation facilities and rapid means of communication. In 1867 the railway systems of the country, since expanded into transcontinental proportions, were limited in scope. This was especially true of the Maritime Provinces, where the stage coach was still an established and very necessary institution when the Confederation era dawned Nova Scotia was served by two short lines of road, running from Halifax to Truro and from Halifax to Windsor respectively, a matter of some hundred miles of track in all. New Brunswick likewise had but two railways, one connecting St. John and Shediac and the other St. Andrew's and Woodstock. Prince Edward Island, which has now a system of 275 miles, was without any railway at all. In short, the three Maritime Provinces among them had only about 300 miles of road in operation, whereas today their mileage extends to 3,668 miles.

The Upper Provinces were somewhat better served. The Grand Trunk, then the longest railway in the world under one management, ran from Portland, in Maine, to Sarnia, in Ontario, and from Riviere du Loup, on the Lower St. Lawrence, to Richmond, P.Q. Its most formidable rival was the Great Western, running from Niagara Falls through Hamilton, to Windsor, with a branch from Hamilton to Toronto. Northward stretched lines from Prescott and Brockville to Ottawa, from Port Hope to Beaverton, and from Toronto to Collingwood. All the rest of the network of roads now traversing both old and New Ontario were non-existent.

Railroad Through Traffic

The idea of through traffic was only just being evolved in 1867. The Great Western, then a wide-gauge road, as were most of the railways in Canada, had laid a third rail from Windsor to Niagara Falls and built a car ferry for service across the Detroit River, in order to secure a slice of the business between the newly developed settlements in the Middle West and the seaboard. The Northern Railway from Toronto to Collingwood was paying so much attention to the traffic it was receiving from the upper lakes and trans-shipping at Toronto for lower lake ports, that settlers along the line complained of the difficulty of getting their cordwood shipped to Toronto. In fact, the promoters of the Toronto & Nipissing and the Toronto, Grey & Bruce made it a point in soliciting financial aid from the municipalities that they would serve the settlers better in this regard that they were receiving.



LOCK No. 1, NEW WELLAND CANAL.

THE DEEP CUT, A VIEW OF THE W ELLAND CANAL IN THE EARLY DAYS.

Communication between the Maritime Provinces and the Upper Provinces in those days was usually by coasting vessel from Halifax or St. John to Portland and thence by Grand Trunk to Montreal. The extension of the Halifax-Truro road to Pictou, completed in the Confederation year, gave a new summer route up the St. Lawrence to Quebec, while one of the fruits of the new political arrangements between the provinces was the establishment of a line of steamers to run from Montreal and Quebec to Maritime Province ports. Otherwise it was possible to take a longer stage journey up the St. John valley from the railway terminus at Woodstock to Edmundston and across the height of land to Riviere du Loup, where the Grand Trunk terminated. This was the route by which the British regulars journeyed to Upper Canada at the time of the Fenian scare.

Victoria Tubular Bridge

The recent completion of the Victoria tubular bridge at Montreal was then filling the minds of visitors with awe and astonishment. It was hailed as one of the wonders of the world, a scientific achievement without a peer in the history of construction. Its three million cubic feet of masonary, its eight thousand tons of iron, its enormous length, its great cost, were dilated upon in unmeasured terms of admiration. For the times it was indeed a remarkable engineering feat, but since then many a far more wonderful undertaking has been completed in Canada, which illustrates still further how the country has progressed.

Canada's canal system had by 1867 reached considerable proportions and comparatively speaking, traffic by water was of more importance than that it is to-day. The lakes were covered with sailing craft, while steamboats were far more numerous than they are now. Of

course, all these vessels were so much smaller than the big freighters of the twentieth century that mere numbers were insignificant. At the same time they provided a most picturesque element in the picture of Canada in 1867. The passage of fifty schooners a day through the Welland Canal was by no means an unusual experience in the year of Confederation.

The canals were much smaller than they are to-day. Those on the St. Lawrence, by means of which ships passed up from Montreal to Lake Ontario, contained but nine feet of water, while the locks were limited to 200 feet in length. Notwithstanding this, records of vessels are not uncommon which had sailed down from the upper lakes and, passing through these canals, had later crossed the Atlantic.

Conditions of Travel

Traveling conditions in the year of Confederation were none too satisfactory. As compared with the luxury of the present day, a journey even for a short distance was an arduous and uncomfortable undertaking. In the Maritime Provinces, if a traveler preferred an overland journey instead of a trip by coasting vessel, he would have to put up with the inconvenience of a wearisome ride in a big, lumbering, springless stage over rough roads, his only solace the occasional pauses for rest and refreshment at old-fashioned change houses. In the Upper Provinces, he would have to contend with the wretched service of what were referred to at the time as the most poorly conducted railways in the world.

Two trains a day in each direction were sufficient to accommodate the traffic between the two largest Canadian cities. One made the journey by day, the other by night, and the run was scheduled for something like fourteen hours. The locomotives burned wood and there were frequent stops en route to re-load the tenders. Cars were small and light, the track poorly laid and the bumping and jolting terrific. One wretched tourist who endeavored to beguile the telium of the journey by a game of draughts found to his disgust that it was quite impossible to keep the men on the board.

Postal System

The postal system in Canada fifty years ago differed very little from the present system except that very much higher rates of postage had to be paid, and it took much longer for letters to reach their destination. The rate to points in Canada, that is, Ontario and Quebec, was five cents; to the United States, 10 cents, and to England, 12½ cents. A special weekly service to Halifax, via Portland, having been arranged, a business man in Toronto or Montreal could send a communication to Nova Scotion for the sum of 12½ cents. As for British Columbia, it cost 25 cents to forward a letter to the Pacific Coast.

Statistics for the year 1863 show that there were in the Upper Provinces, 1,974 post offices in that year and that the number of letters carried was 11,000,000. New Brunswick had 375 post offices, in which 833,625 letters were handled, and Nova Scotia 493 post offices, with 1,467,726 letters. The year's revenue for the three provinces was $853,778, and the expenditure, $896,303. As an indication of the extent to which the postal service has since expanded, it may be said that in 1915, the revenue for all Canada was over thirteen million dollars and the expenditure nearly sixteen millions.

Telephones

While the telephone was unknown in 1867, the telegraph and the Atlantic cable were both in existence, and so far as telegraphic communication was concerned, Canada was well served. Indeed, in Nova Scotia the boast was made that they had more lines of telegraph per inhabitant than in any other country in the world and, what is even better, lower rates. In Ontario and Quebec, the Montreal Telegraph Company, with over 3,000 miles of wire, controlled the situation, while in the Maritime Provinces the lines, about 2,000 miles in extent, were controlled by the American Telegraph Co. As there are to-day over 200,000 miles of wire in the telegraph systems of the country, it is obvious that here again there has been vast development.

The story of the telephone is all contained within the limits of the Confederation era. There were no telephones when Confederation was born. To-day there are between six and seven hundred thousand instruments in use, with over a million and a half miles of wire connecting them.

Electrical Street Railways

Electric street railways have been another modern development. In fact, in the year of Confederation, horse cars had only just come into use. Toronto's system had been opened in 1861. It consisted of six miles of track on Queen and Yonge streets, with eleven cars and 70 horses, a total investment of only $175,000. Montreal had also about six miles of track with similarly small equipment. Halifax was a third city with a system of horse cars at that time. The innovation was not welcomed. One critic complained that "the street railway is an institution for the benefit of those who ride, at the expense of those who drive, and is a flagrant violation of the rights of the majority. The horse railway is a permanent obstruction; it practically divides a wide street into two narrow ones and a narrow one into two lanes. It is questionable whether it will be found profitable in Canada."

In the light of this hostile attitude, it is interesting to note that the tiny systems in the three leading cities of 1867 have since developed into a vastly important series of electric lines, located in practically every city in Canada, operating upwards of 1,700 miles of track and carrying annually six hundred million passengers. The capital invested in them amounts to over $150,000,000.

Trade and Finance

Trade and finance have shown marvelous expansion in the fifty years of Confederation. When it is considered that in 1868 the country's total trade only amounted to a little over $131,000,000, of which $57,500,000 represented exports; that the export of manufactured products in that year scarcely amounted to $2,000,000 and agricultural products exported were under $13,000,000 in value, then the growth becomes all the more remarkable, for, in 1916, Canada's trade amounted to nearly a billion and a half dollars; her exports of manufactured products to $242,000,000, and her exports of agricultural products to $250,000,000. Her mineral exports in the same period jumped from $1,800,000 to nearly $67,000,000, and the products of her fisheries from $3,500,000 to over $22,000,000.

The development of trade has been graphically reflected in the expansion of the financial institutions of the country, notably the chartered banks and the insurance companies. There were as a matter of fact, more banks doing business in 1867 than there are to-day, but the banks of the Confederation year were very much smaller and, in several cases, they were in a notoriously shaky condition. In all, there were twenty-six of them in existence, with a paid-up capital among them of approximately thirty millions, or about a quarter of the paid-up capital of the twenty-one institutions now operating under Dominion charters. There were about 120 branches doing business, the large majority of which were located in the Upper Provinces.

Since 1867, sixteen of the twenty-six chartered banks on the list in that year have disappeared, either through failure or amalgamation, leaving but ten of their number to carry on the traditions of the pre-Confederation days. The survivors, in point of age, are the Bank of Montreal, Bank of Nova Scotia, Bank of British North America, Bank of Toronto, Molson's Bank, Bank Nationale, Merchants Bank, Banque Provinciale, Union Bank, and Canadian Bank of Commerce. Eleven new banks have been established, bringing the present total up to twenty-one.

To-day Canadian banks have over 3000 branches in Canada alone, not to mention agencies in the United States, the West Indies, and elsewhere. Their assets have grown since 1867 from seventy-five millions to well over two billions; their liabilities from forty millions to over eighteen hundred millions. They have deposits of over fifteen hundred millions as compared with twenty-five millions fifty years ago, and their circulation has expanded in the half-century from nine millions to over $132,000,000.

Insurance

Life insurance was the smallest of Canada's financial institutions in 1867. Only one Canadian company—the Canada Life, which had been organized in 1847—was operating, and the total insurance in force of all companies, including British and American, did not exceed $30,000.000. Progress in this one business alone has been little short of phenomenal. Company after company has been organized until to-day no fewer than twenty-six domestic companies are

reporting annually to the Dominion Department of Insurance, not to speak of fifteen British and sixteen American companies.

By the end of 1916, the insurance in force on the lives of Canadians amounted to nearly a billion and a half dollars, of which nine hundred millions was carried by our own Canadian institutions. The latter, whose assets in the year of Confederation were a mere bagatelle, now show accumulated wealth approximating three hundred million dollars; their annual income runs to over sixty million dollars; while they disbursed last year to policyholders or to their beneficiaries nearly twenty-five million dollars in cash.

The business of fire insurance has enjoyed a similar expansion. Our Canadian companies, then few in number and uninfluential, had at risk in 1867 about fifty million dollars, on which they were receiving premiums of somewhat less than half a million dollars and paying losses of from a quarter to half a million dollars a year. Last year, the domestic fire companies had $663,758,129 at risk, on which they were receiving premiums of nearly five million dollars, while they met losses during the year of over half that amount.

One might proceed and produce figures bewildering in their detail to demonstrate how far Canada has progressed in every department of business activity since 1867. The tremendous expansion of agriculture due to the opening up and settlement of the West; the development of mining, which is placing Canada in the forefront of the mineral-producing countries of the world; the growth of the fisheries; the extension of hydro-electric power in industry; these and a hundred other matters might easily be referred to as affording means of gauging the country's fifty years of progress. However, enough has been written to give a faint idea of the Canada of fifty years ago and with this in mind it is not difficult to picture mentally the extent of development.

CANADA'S COAL OUTPUT

THE Mines Branch of the Department of Mines, at Ottawa, has received from the principal coal mine operators returns of their production during the first three months of 1917, on the basis of which the following estimates have been made of total production during this period.

According to these estimates the total production of coal during the first quarter of 1917, was 3,590,991 short tons, comprising 1,233,934 tons in January; 1,143,956 tons in February, and 1,213,101 tons in March. Corresponding records for the year 1916 are not available for comparison.

The record would appear to show that the average rate of production in Nova Scotia and British Columbia was less than the average rate of production during 1916, but greater in the provinces of New Brunswick, Saskatchewan and Alberta.

The exports of coal during the three months' were 501,570 tons, as against exports of 737,744 tons during the corresponding period of 1916.

The imports of coal during the three months were 3,921,824 tons, as against imports of 4,002,892 tons during the corresponding period of 1916.

The production of oven coke during the first three months of 1917 was 308,690 tons—the imports during the same period being 207,139 tons, and the exports 5,606 tons.

Revised statistics for 1916, as compiled by the department, show that the total consumption of coal was 29,865,856 short tons, against 23,906,692 in 1915. Production in Canada was 14,483,395 tons, against 13,267,023 in 1915, and imports, 17,850,603 against 12,465,902. Production figures by provinces as given below show decreases in the East, but increases in the West:

Production by provinces:—

	1915 Short Tons	1916 Short Tons
Nova Scotia	7,463,370	6,912,140
New Brunswick	3,360,818	143,450
Saskatchewan	2,065,613	281,300
Alberta	240,107	4,559,054
Brit. Columbia	127,391	2,584,061
Yukon	9,724	3,300
Totals	13,267,023	14,483,395

WINNIPEG FROM ST. BONIFACE FERRY LANDING—A FEW YEARS AFTER CONFEDERATION

Development of Ocean Service Shipbuilding in Canada--V.

By C. T. R.

In addition to the widespread requisitioning of vessels for transportation purposes by the Allies, the war attendant and normal merchant ship losses and the many months' almost complete cessation of new construction on the part of the latter, the merchant marine of the world has had the misfortune to become to a large extent the target for enemy submarine activity. All nations have suffered in this respect, hence the almost feverish anxiety being displayed by shipping interests to have the losses made good at the earliest possible moment.

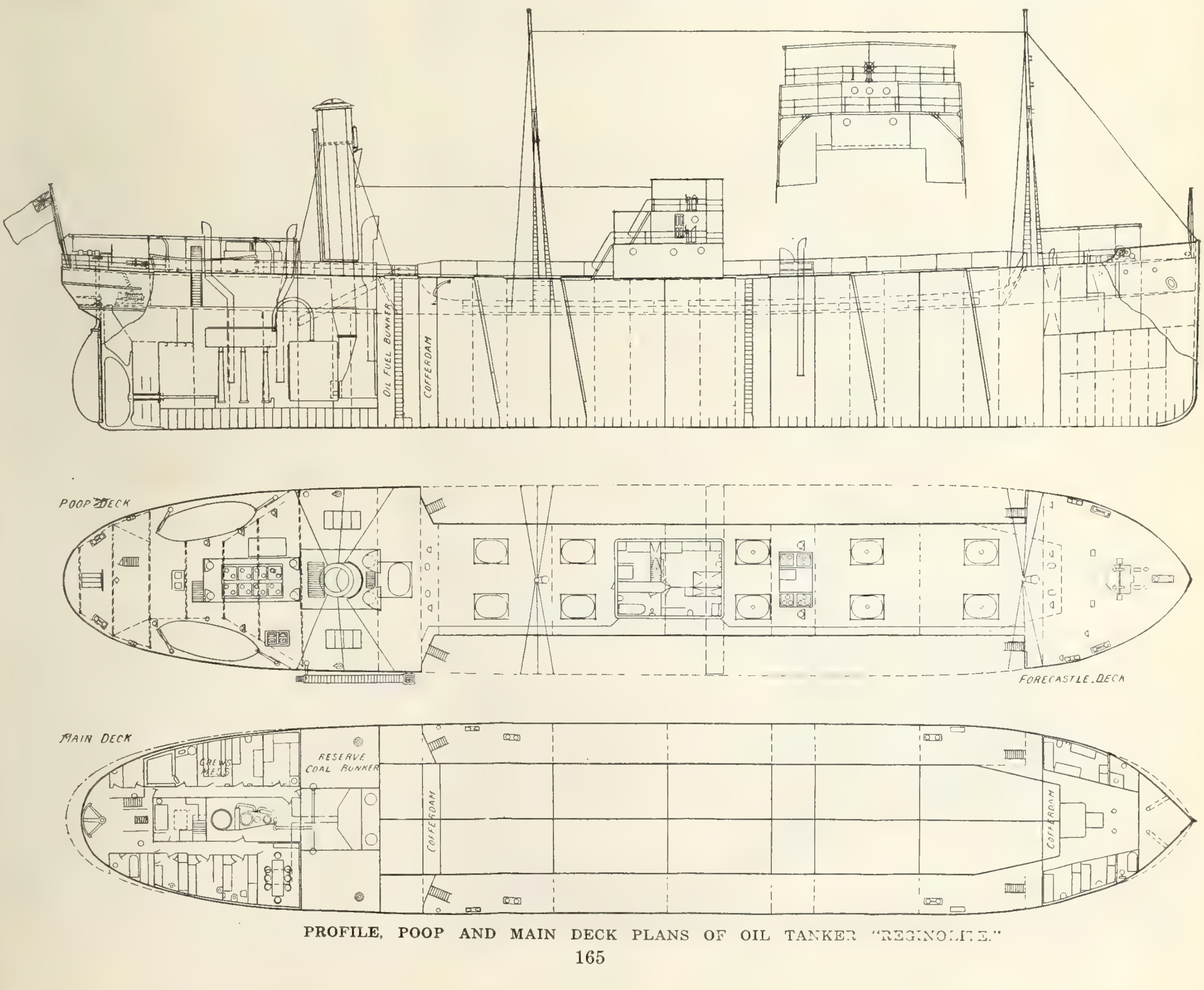
OCEAN GOING OIL TANKER LAUNCHED AT COLLINGWOOD

THERE was launched by The Collingwood Shipbuilding Co., Collingwood, Ont., on Thursday, June 21, the oil tank steamer Reginolite, which has been built to the order of the Imperial Oil Co., Toronto. This is the fourth vessel the builders have constructed for The Imperial Oil Co. and leaves a fifth, the Talarolite still on the stocks. The Reginolite is intended entirely for ocean service and is of the following dimensions: 250 ft. between perpendiculars; 259 ft. over all; 43 ft. 9 in. beam; 25 ft. deep to the upper deck, deadweight carrying capacity, 3500 tons.

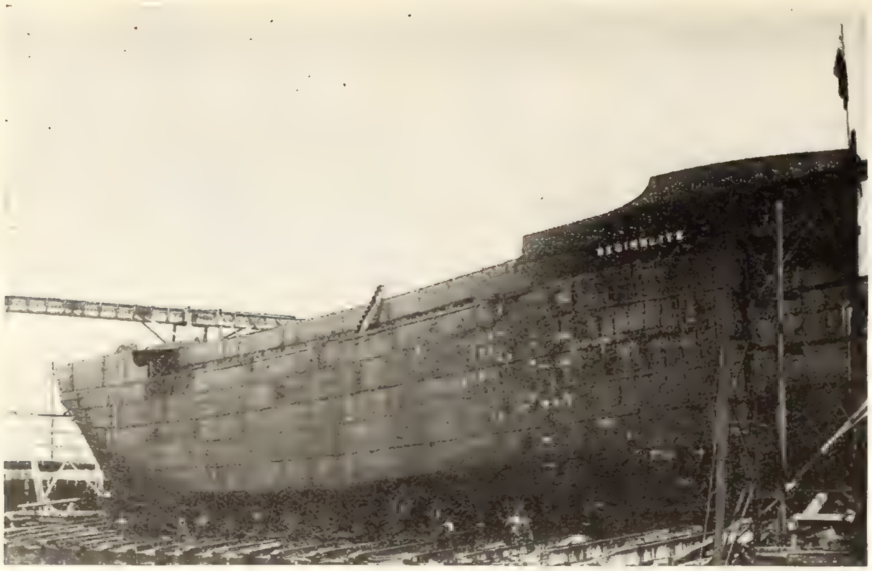
The propelling machinery consists of a set of triple expansion engines with cylinders 18 in., 30 in. and 50 in. by 36 in. stroke. Steam is supplied by two Scotch boilers 13 ft. 6 in. diameter by 11 ft. long, working at 180 lbs. pressure. The vessel takes the highest class in Lloyd's Registry for ocean service and the construction has been under the supervision of Captain R. W. Henderson, marine superintendent for the owners. From the line drawing showing the vessel profile and deck plans, a very good idea is to had of the general design and detail arrangement.

"WAR WASP" LAUNCHED

ON July 9, the steel freighter War Wasp was successfully launched from the shipbuilding plant of the Nova Scotia Steel & Coal Co., at Trenton, N.S. She is the first ocean-going steel steamer to be built in the Province of Nova Scotia, and naturally the event created unusual interest. Residents of New Glasgow and Trenton were out in large numbers to witness the vessel take to her native element, in addition many visitors from adjacent towns helped to swell the crowds who lined the banks of the East River. Miss Marion Cantley, daughter of the chairman of "Scotia," performed the christening ceremony, following which Mayor Grant presented Col. Cantley with a piece of silver from the citizens of New Glasgow, to commemorate the occasion. Congratulatory addresses were also presented to Col. Cantley by the town councils of Trenton and New Glasgow. A description and illustration of the War Wasp appeared in our April issue. We understand the vessel has been sold to the British Government, although primarily intended for the company's own coal and ore-carrying trade.



PROFILE, POOP AND MAIN DECK PLANS OF OIL TANKER "REGINOLITE."



OIL TANKER "REGINOLITE" ON THE WAYS

PIPE COVERING

IT may be said that in most cases it pays to use the best commercial pipe covering obtainable, because where the material is paid for many times over during the first year by the saving effected by its use, the first cost loses much of its weight as a determining factor in the selection of type of covering to be used. In view of the results of thickness tests, it is a deplorable fact that few steam lines at the present time are provided with thick enough a covering for the greatest net saving. However, where fuel is cheap and the lines are in use only a small percentage of the time, the cheaper coverings have their advantages. Also, there are places, as on some heating systems, where the heat lost through the coverings is not wasted and the object of covering the pipes at all is to keep tunnels, etc., cool enough that men may work in them. Therefore, a careful study of conditions is necessary before a certain type of covering can be recommended for a given piece of work.

The durability of materials used for pipe coverings is a very important factor in determining the most economical covering for a given set of conditions. It has been pointed out that the proper basis for comparing costs is the cost per year and not the first cost of the material. This is true because the covering giving the greatest length of service for a given first cost and efficiency is obviously the one to select. In general, fibrous coverings are more durable than the molded forms; since the latter tend to revert to their original powdered state due to vibration and rough usage, while those made of fibrous material firmly felted together do not.

The guidance specification for reciprocating triple-expansion marine engines up to 3500 horse-power for cargo vessels, issued by the North-East Coast Institution of Engineers and Shipbuilders, contains the following formula for the indicated horse-power in average sea conditions: I.H.P. $= D^2 S N \div 700$, where O $=$ diameter of low-pressure cylinder in inches, S the stroke in feet, and N the revolutions per minute. $N = 32 (S + 4) \div S$. The ratios of cylinder areas for 180 lbs. pressure are: High-pressure, 1; medium-pressure about 2.74, and low-pressure about 7.5.

OIL TANKER "REGINOLITE" ENTERING THE WATER.

CANADA'S OCEAN SHIPPING

GOVERNMENT action for the improvement of ocean transportation between Canada and Great Britain, France and Italy, and systematic advertising of Canada's resources abroad, are advocated by the special Trade Commission appointed in May, 1916, and which carried on its inquiries overseas during that summer.

The commission, which consisted of Chairman James W. Woods, of Toronto; Vice-Chairman Theo. H. Wardleworth and Frank Pauze, of Montreal; H. Edmond Dupre, of Quebec; W. Frank Hatheway, of St. John, N.B.; George W. Allan, of Winnipeg, with Roy Campbell, of Montreal, as secretary, made extensive investigations of trade conditions and trade opportunities in Britain, France and Italy, and has now presented its report, which was laid upon the table of the Commons by Sir George Foster a few days ago.

The commissioners say that throughout their inquiry they found the transportation question uppermost. They contend that the "established lines have not given that service in linking up Canada with other countries which might have been expected, and it has been of such a character as seriously to impair their usefulness as means of developing Canadian trade."

To Reorganize Transport

"Canadian ocean transportation will have to be completely reorganized if the Dominion is to derive the fullest benefit from her natural resources and manufactured products." They believe that the Government should take up this question, and, with Mr. Pauze dissenting, suggest that "Imperial control might so adjust the empolyment of tramp ships that the different needs of the Empire might be met as requirements of the crops or season demand."

No subsidies, bounties or concessions, they hold, should be granted to steamship companies or individual vessels until the question of transportation has been thoroughly studied, and until the methods of moving Canada's grain, etc., are based on sound and scientific lines. They suggest that the Government should give attention to shipbuilding in Canada and also consider means to assure better rates of insurance for vessels using the St. Lawrence route.

In their inquiry they also found the fiscal question an important one. "The impression of the commission in the countries visited," they say, "was that it was desired that a preferential tariff should be given by each Allied nation to the other Allies; that there should be an intermediate tariff for neutral countries, and that enemy countries should be penalized as far as possible by a tariff wall, which, if not prohibitory, would restrain unfair competition and 'dumping' methods which have been such an unsatisfactory feature of commerce during the past."

The commissioners find that a more systematic method of advertising Canada would be a distinct advantage to the Dominion. They think it would be possible for the Government to devise a scheme which would impress the various interests and secure co-ordination in mak-

ing Canada and its resources better known throughout the world. To carry out this plan they suggest that the Government might employ a man with a grasp of all branches of advertising to act as an adviser. They also advocate the establishment of permanent exhibitions of Canadian raw and manufactured products in Britain, France and Italy.

HUGE GRAB-BUCKET DREDGE

THE use of the grab-bucket type of dredge has reached two special developments in American practice. First, great depth of dredging, with short reach of jib to load material into barges alongside; this is for harbor work. Secondly, comparatively shallow dredging, but with immense reach; this is for use in river work, and for building dykes or levees along rivers to afford flood protection.

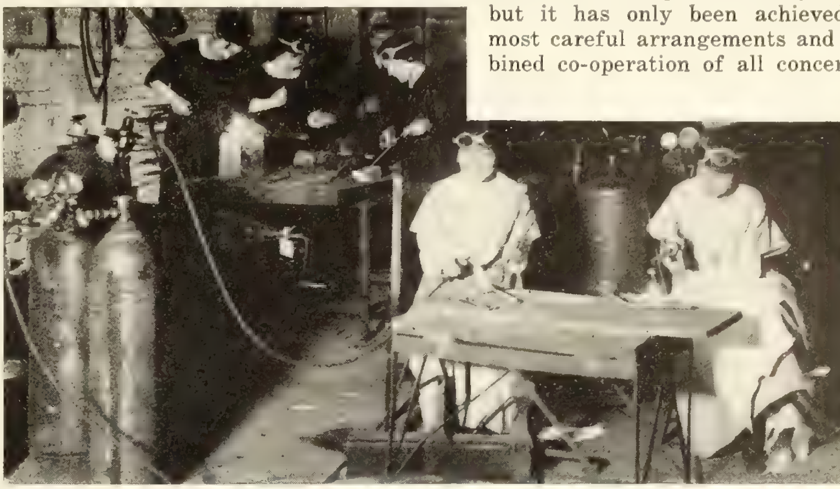
A huge dredge of this latter type has been built for work on rivers in California. The hull is 140 ft. by 61 ft., built of steel trusses and frames, with steel plating for the sides and a timber bottom and deck. It is 13½ ft. deep on the centre line. At the forward end is an A-frame 68 ft. high, built of timbers 20 in. by 20 in., each 76 ft. long. This is supported by inclined back-legs seated at the stern. Midway between the feet of the A-frame is a heel casting, to which is fitted a timber boom or jib 195 ft. long, 22 in. by 22 in. in section, trussed vertically and laterally. A topping lift or luffing tackle leads from the end of the boom to the top of the A-frame. All machinery is in the hull. The superstructure has the crews' quarters at the deck level, with the officers' cabins above, and over all the enclosed operating house, corresponding to the pilot house of a steamer. The jib carries a clamshell or two-section bucket of 5 yards capacity.

When at work the boat is held by three vertical timbers or spuds, resting on the river bed. The stern spud is fitted to a slotted casting, attached to a steam cylinder. Steam being admitted to the cylinder, the dredge is pushed forward. The dredge has two tandem cross-compound condensing engines on the ends of the main shaft from which the cable drums are driven by gearing.

WOMEN WELDERS USE OXY-ACETYLENE APPARATUS

CURRENT developments all tend to show that when the interests of their country demand it, Canadian women will be found willing and able to help in any possible manner. Among the many industrial occupations which have been invaded so successfully by women in Britain is that of blow-pipe operation involving the use of oxy-acetylene apparatus for welding and cutting. It is a peculiar fact that, while the physical effort required in this work is small, every aspirant to the occupation does not always turn out successfully. Skill, concentration of mind, lightness of touch and deftness of hand and eye are necessary factors of success, and that the female temperament contains these qualifications is evidenced by the number of women operators who have recently acquired a high degree of proficiency in this work.

The rapid development of aeroplane construction in this country opened up much work in the welding and cutting line which was particularly suited to the employment of women workers. Of comparatively small dimensions, and light weight, and, from their very nature, necessitating the utmost reliability of manufacture, the parts required are now being satisfactorily made by locally trained female operators. For some considerable time now, selected pupils have been receiving instruction in the shops of the Carter Welding Co., Toronto, and the high percentage of these who make successful operators has been a most pleasing feature of this interesting industrial development.



GROUP OF PUPILS RECEIVING PRACTICAL TRAINING IN CUTTING, WELDING AND BUILDING UP AEROPLANE PARTS.

CANADIAN GIRLS WHO HAVE QUALIFIED AS WOMEN WELDERS IN THE USE OF OXY-ACETYLENE APPARATUS.

SHIPBUILDING IN GREAT BRITAIN

ALL THIS year, the efforts of the British shipyards and of the Shipping Controller have been concentrated on the task of pushing on the Government standard and other mercantile vessels which are in hand. These efforts are meeting with success, and the output of merchant tonnage is steadily increasing, but it has only been achieved by the most careful arrangements and the combined co-operation of all concerned—the Admiralty, the shipyard officials and workers, the iron and steel producers, the marine engine-makers—and these in turn have meant an insistent call for raw and finished materials, which are now, by all accounts, coming forward satisfactorily.

Iron ore is being mined at home and imported from Spain on a larger scale, the ironmasters have lighted additional furnaces, and the output of steel has been steadily increased. All the reports from the iron and steel centres agree that supplies of ship plates and angles, as well as forgings and castings, are now more in keeping with the demand than they were last year. The assembling and allocation of skilled and unskilled labor to the different yards has been no easy task, but it has been accomplished by dint of organization, and to-day there are even women doing useful work in our shipyards. The result is seen in the launching, fitting out, and completion of merchant ships, of which the world hears nothing.

"What dirty hands you have, Johnny," said his teacher.

"What would you say if I came to school that way?"

"I wouldn't say nothin'," replied Johnny. "I'd be too polite."

PACKING POINTERS

A BABBITT METAL or brass ring in the bottom of the box of an outside packed plunger is a great aid to packing. It will pay for itself many times over, not only in cost of packing, but also in the general neatness and cleanliness around the pump.

When using packing with high pressure or superheated steam, it is not advisable to use cylinder oil as a regular lubricant. A mixture of cylinder oil and graphite is good, the cylinder oil simply serving to help flow the graphite into position. The graphite gradually fills in the smaller pores of the rod and levels them up, making a smooth surface. The smoother the surface, the less friction there will be between the rod and the packing.

Some engineers make a quick and permanent joint out of a self-vulcanized packing by turning on three or four pounds of steam after the joint is made, and when the joint is thoroughly warmed, dashing a few buckets of water over it, thus cooling the flange and the packing. This causes the packing to harden into position at once. It is a quicker process than that of self-cooling.

Packing if treated right will do a great deal of good honest labor for its master but, if forced, it balks and will not work. A man should be patient with packing, and use it very carefully until it thoroughly conforms to the shape of the box. If it be given plenty of room and well lubricated, it will last for years; but if squeezed into a confined space and run dry, it will soon lose its life.

Stuffing Box Notes

It is a good plan for every engineer to keep a little note book in which to tabulate the diameter of every rod, the diameter and depth of its stuffing box, and the size of the packing required. This enables an order to be made out quickly, and at the same time with certainty. The measurement of a rod in motion, is always guess work. It is also a good plan to number each box that requires packing, and keep extra packings on shelves in the order of the number, so that it can be quickly found in case of emergency.

A good engineer can pack with almost anything. A poor engineer can spoil the best of packing. An engineer, who treats carefully the packing which he puts in and takes care of it as he would a new suit of clothes, will find that it will stand by him and give good service. If he abuse it, however, particularly with the unwise use of a wrench, he will find that it will wear out very quickly. Patience and carefulness are the watchword of success with packing.

Before inserting a packing ring, it should always be dipped in cylinder oil. The advantage thus obtained, far more than compensates for the corrosive effect of the oil. The oil as a lubricant, prevents excessive friction and allows the packing to place itself in position without being burned, and while the oil will affect the rubber, it will not produce as quick and disastrous an effect as the excessive heat would, if no lubricant were used.

Sheet Packing

Some engineers make a practice of placing sheet packing in position on a flange and then cutting the edges with a hammer. This is very poor practice, as it leaves a bruised and ragged edge on the rubber which has a tendency to tear. The best way of cutting is to first mark the outline of the gasket on the sheet and then to cut with a sharp knife. This leaves a clean cut edge and lessens the danger of a blow-out.

When drawing up a gasket, draw the bolts up gradually and on all sides, so that the two flanges approach each other as nearly parallel as possible. If a gasket is drawn up tighter on one side at the start, the gasket is distorted and a probability of blowing out is almost assured. If there are eight bolts in the flange, draw number 1 partly, then skip to number 5, then to number 7, then to number 3, and then to the intermediate bolts. Repeat the same process, drawing them a little tighter. Repeat again setting them up in position.

REMOVING BROKEN SET SCREWS

By D. A. Hampson

THE quickest removal of a broken set screw ever witnessed by the writer was accomplished by a special tool made from an overgrown three-cornered file. About two-fifths the length of the body of the file had been broken off its smaller end, and the newly broken end on the larger piece ground down to a pyramid shape. Most of the tang was also removed. This tool had been made some time before and for this class of work. The other tools used were, a drill, a lever, and a wrench. The diameter of the drill used was possibly half, but not more than that, of the screw to be removed.

A hole was first drilled in the centre of the broken screw, deep enough to give the special tool a chance to work without its point coming in contact with the bottom of the said hole. This special tool was then placed with its sharp end in the hole and the lever placed inside the frame of the machine and across the tang of the tool, then pressure applied to force the tool into the hole. The tool was then turned backwards with a wrench. At first it acted like a countersinking tool, but soon got hold of enough metal to enable it to give the broken screw a turn and the job was soon finished.

On paper the job looks bigger than it really is. A large three-corner or square can be easily made into one of these tools and if a size strong enough for the work, will last indefinitely. The drill, wrench and lever are invariably on hand in any plant. The depth of the hole required is very much less than where a square tool with parallel edges is used for turning the screw.

These columns have already given us some kinks on which a screw clamp is useful and I believe that in connection with the above scheme a screw clamp could be used sometimes more conveniently than, and instead of, the lever. It would be advisable to select one having a depression in one of its bearing surfaces into which the tang of the tool could bear while in use. With both clamp and lever to hand, the one best adapted to the construction of the affected part and the neighboring members could be used.

LAST RESORT ON A BALKY LUBRICATOR

By J. E. McCormack.

ONE of a pair of engines of which I had charge was equipped with a type of single connection lubricator in which the rate of feed was observed by watching the drops of water pass down between a glass disc and a polished brass plate behind it. This lubricator generally gave excellent service, but one day it was not working so well as usual and the former engineer, now promoted to superintendent, happened along just as I was tinkering with it. When he saw that my efforts had failed, he remarked, "Perhaps it is airbound," and applied a bicycle wrench to the nut connecting the brass arch to the top of the condensing chamber, turned the nut a little to allow leakage, held it there until steam began to come, tightened it again, took a look at the sight feed, and passed on. The lubricator was working nicely. During my stay this lubricator did not balk many times and when it did I always tried the orthodox remedies first. If they did not succeed I then tried this remedy always as a last resort, and so far as I can recollect, it always succeeded probably partly because by the time I got around to the kink no trouble except the air-bind remained. I can not explain the why and wherefore; I only know it produced results. I am inclined to think this trait is peculiar to that particular class of lubricator if not to that individual lubricator itself, but as I consider the remedy simple and not generally known, I pass it on, thinking it may some day help out some one else using a lubricator of similar construction.

Greatest Virtue.—One afternoon a philanthropic party visited a public school in the poorer section of a big city, and while making a study of the conditions in the knowledge factory, thought it proper to ask the youngsters a few questions on different subjects.

"Can any little boy or girl tell me," said he, very impressively, "what is the greatest of all virtues?"

Nothing doing. Every bright little face looked as if the mind back of it was doing a hard piece of thinking, but there was no reply.

"We will try it again," encouragingly said the philanthropist. "What am I doing when I give up my time and pleasure to come and talk to you in your school?"

"I know now, mister," exclaimed Johnny Smith, raising his hand and snapping his fingers. "Buttin' in."

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

OCEAN TRAVELLING—PAST AND PRESENT

By Capt. Geo. S. Laing.

THE phenomenal development of merchant shipping in the last sixty years marks a contrast that cannot be duplicated by any other line of scientific progression. Just look at the sailing ship in our first illustration, and you see the type of craft that brought over to America our fathers or grandfathers. Thousands of passengers left the British Isles for America, Australia, New Zealand and Newfoundland in small sailing ships like this. By way of comparison, let us take the Atlantic passage, as it concerns this continent most. In duration the trip lasted often from thirty to forty days.

Atlantic Voyage 50 Years Ago

We board one of the "white wings" in Liverpool and have our quarters in the 'tween deck shown us by the steward. About half a dozen well-to-do folks have a cabin berth right aft, but the other two hundred folks are to a great extent en masse. The tow boat waits at the dock head and a few relatives are congregated there to wave a handkerchief or shout a last word of good luck to the dear ones whom they may never see again. At last the stern line is let go from the pier head, and the saucy side-wheeler America is towing the ship Serapis down the Mersey. Rock light is passed and the Formby and Crosby channels gone through. At Point Lynas, on the Welsh coast, the tug signals for the hawser to be pulled in.

This ordeal starts the voyage of sailor melody. The wind being from the northeast, the impatient skipper stamps and raves about getting full sail on the vessel. Passengers notice for the first time that the ship sways gently to the surge of the Irish Sea, and with longing eyes and fear in their hearts they bid adieu to the land of their birth. Some are wondering what may happen before they see land again.

Now that the tow rope is aboard, the tug swings under the lee quarter, and takes off the pilot and a packet of mail, the last link of communication. Men are seen running aloft as agile as monkeys to loosen the sails from the yards, while the majority stay on deck to haul out the sheets and halyards. No wonder the passengers stand aghast. The singing and shouting that goes on while setting sail is enough to make any shore folks nervous, and the noise of blocks, capstan bars and chain hooks on the wooden decks sounds like thunder to those who may be in their berths below.

Most of the women and children have already gone below, as it seems too maddening to stay on deck, and the wind is whistling through the rigging to a rising sea. The men and boy passengers are soon the only spectators, and, as the tars pile more and more canvas on the Serapis, so does that good ship heel over on her side like a racing yacht.

By sundown the Serapis is staggering along under full sail, and the captain walks the poop deck with a glint in his weather eye that means, "Get to Boston as soon as you can, old girl." It is a beautiful sight now to watch the foaming water pass along under the lee rail. Some of the children below are asking mother why the floor is like a hill, and, as the ship lays over in the squalls, any loose articles that can get room to move roll down to the lee side.

It is dark now and the first night at sea is a funny one to the future Americans. Lamps filled with slow burning vegetable oil or colza are hung up in the 'tween decks. These lamps move freely in gimbals, so that no matter how the ship rolls and dives the lamp itself keeps upright. The passenger quarters are in semi-darkness both day and night. In day-time the port holes in the ship's side are far too small to flood the place with good night, and at night the colza lamps are few in number and act similarly to a candle.

SHIP "SERAPIS," PASSENGER TRADER ON NORTH ATLANTIC 50 YEARS AGO.

Sleeping Accommodation

How about sleeping? Those who have beds on the high or weather side are afraid they will be thrown out with the lurch, while those on the lee side feel as if the vessel had just another inch to go before turning turtle. What, between seamen's heavy sea boots and the continual manipulation of the yards and booms, etc., the noise overhead would banish sleep unless exhaustion came to the relief. Refreshing slumber was out of the question; true, the kiddies dosed a little, but that was all. Next morning those who were not sick with the badly ventilated quarters would scramble up on the main deck and view the sky and sea, for the Irish coast was a blur on the horizon astern. Food and drinking water were doled out in quantities that made one wonder if life on board ship was a question of who could survive longest on the worst kind of food.

Heavy Weather Experiences

A gale is springing up and the wind hauls further aft, which allows the ship to rise from her side, but rolling is now in evidence and the children are wondering if the floor wants to change places with the roof. The most of the women have gone to bed for the voyage, while the men folks try hard to play the valet and cheer the sick. The rolling is accompanied with heavy seas breaking on board, some of which finds its way down the companion steps into the 'tween decks. When the sea water appears rushing from side to side, the folks in bed think the ship is foundering, but sailing ships don't go under so easily as that and all is well. Thirty or forty days of this kind of life would dishearten the majority of shore people.

Without exception, the Atlantic passage in a sailing ship was made up of days like these just depicted, with a few breathing spells here and there. We can then size up the situation something like this: Bad food, shortage of fresh water (more sea water than you wanted), cramped and badly aired and lighted quarters, little or no heat, and no attempt whatever to cater for ordinary human comforts. A witty immigrant on landing in Boston from a sailing ship was heard to remark: "That was certainly better than coming over on a whale's back."

The Modern Provision

Now look at the Atlantic liner in the picture. Come on board at Glasgow and

be shown to your berth. A floating first class hotel, that is the impression, and it is in no respect an erroneous one. Every conceivable device to give a home appearance to your surroundings. The berth is inviting with its snow white bed linen and its polished hardwood bureau, wardrobe, couch, etc. Carpets are on the floor, bunks and ports nicely curtained. The ceilings and walls decorated with enamel creams or whites; in short, you have a tiny but snugly arranged temporary home, well ventilated, heated and lighted. As regards cleanliness, nothing further could be desired.

Then there are the luxuriously furnished dining and music saloons on a present-day Atlantic liner. Such places are good enough to crown a king in. Other places could be mentioned, such as nurseries, smoke rooms, ladies' rooms, etc. On deck, under the shelter of a higher one, you can enjoy the sea air and take in the scenery. Even in wild weather, quiet spots to leeward of the deck houses can be found where the view and study of the elements give one food for reflection.

A gentle roll is about all that the average Atlantic liner indulges in, and the trip is done in five or six days on the open waters. Ocean travel as far as passengers are concerned can now be summed up thus: Splendid food and fresh water in unlimited quantities, well heated and ventilated rooms, good light and every attention that can add to the comfort, cheer, and safety of those on board. Add to this, luxuries and dainties, and an atmosphere and tone of a home far beyond the large majority of the people who are temporarily afloat, and you have the up-to-date conditions of those who go to and fro on the mighty deep.

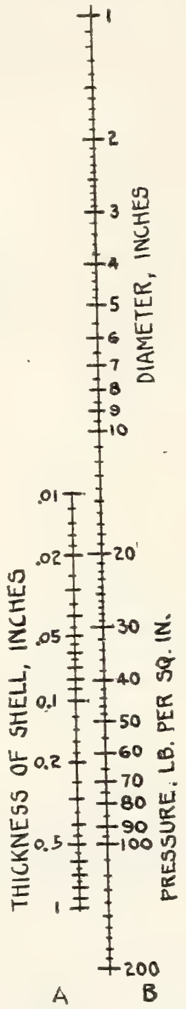
Wireless telegraphy, turbine engines, submarine fog signals, are amongst the latest development of the modern steamship to secure a still more adequate service, and the evolution goes on, each decade bringing further devices on its wings.

HANDY CHART FOR BOILER SHELL COMPUTATIONS

By W. B.

THE accompanying chart will be found useful for determining three different things:

1.—It will give the shell thickness of the boiler, knowing the pressure in pounds per sq. in., and knowing the diameter of the boiler in inches.



HANDY CHART FOR BOILER SHELL COMPUTATIONS.

2—It will give the pressure in pounds per square inch when the other two factors mentioned in (1) are known.

3—It will give the diameter of the boiler in inches when the other two factors also mentioned in (1) are known.

For example, given a boiler made of mild steel, whose internal diameter is 34 inches, and whose shell thickness is .25 inch. What pressure may be safely held within the shell?

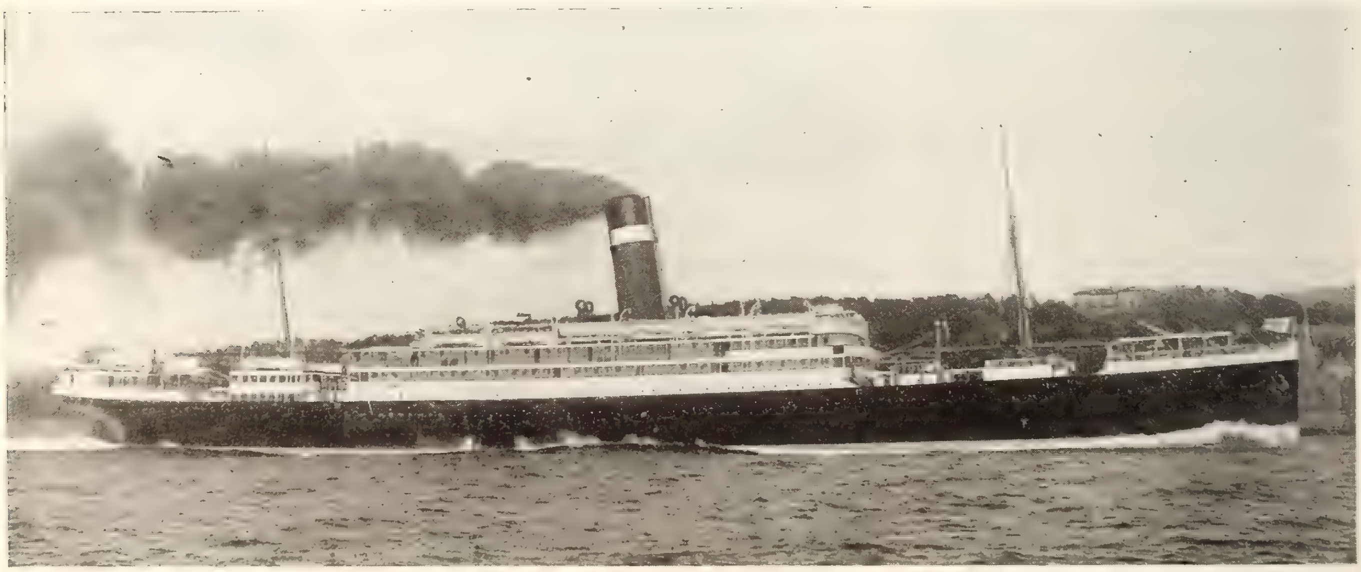
Find the 34 in column B and measure the distance down to .25 in column A. Then from the .25 measure downward that self-same distance, and the answer will be immediately found in column B as 150 pounds per square inch. This chart is based on 10,000 pounds per square inch as the safe stress to which the metal can be subjected, therefore the answer is the safe working pressure to which the shell can be subjected.

In case it is desired to find the thickness of shell, knowing the other two factors, all that is necessary is to locate the two known points in column B and then find the mid-point. The answer is to be found directly opposite that mid-point in column A.

To find the diameter to which a boiler can be safely made, knowing the shell thickness, and knowing the pressure, the operation is practically the same as in the first example cited. This will be better understood when it is pointed out that the shell thickness would have to be the same for a pressure of 34 pounds and a diameter of 150 or for a pressure of 150 pounds and diameter of 34 inches. Do you get the point? That is why the chart is reversible.

The range of the chart is wide enough to cover nearly every common boiler condition. Its highest pressure is 200 pounds per square inch and the highest shell thickness is one inch.

In case the metal is steel, this chart is especially applicable, allowing a factor of safety of nearly six. In other words, where the breaking strength of the metal is 60,000 pounds per square inch, this chart automatically includes the factor of safety of six. If the metal is cast iron, or something weaker, the chart will not hold without allowance being made.



TWIN-SCREW STEAMSHIP "VIRGINIAN" BUILT F OR THE NORTH ATLANTIC PASSENGER SERVICE.

Launching Pressure Calculations and Vessel Motion*

By P. A. Hillhouse, B.Sc., and W. H. Riddlesworth, M.Sc., M. Eng.

The paper describes a method of calculating launching pressures and moments, which takes accurate account of tide, declivity and camber effects. In addition, a form of fore poppet, which has been developed and successfully used by the Fairfield Shipbuilding & Engineering Co., is featured, as are also some model experiments undertaken for the purpose of determining the actual motion of a vessel during the whole process of launching.

NECESSITY FOR DIAGONAL TIES ON FORE POPPET STRUCTURE

After the stern has risen and the bow of the ship is resting upon the fore poppet structure, the latter is being dragged down the ways by its connection to, or friction against, the hull. This force is applied to the upper part of the structure. At the same time, the friction between the ways tends to retard the lower ends of the poppets, and these two forces together tend to trip the poppets as indicated in Fig. 24. Published photographs show that in some cases such tripping has actually occurred.

To resist this tendency it is important that the whole forward cradle should be diagonally braced by a system of struts and ties, as shown in Fig. 25, where struts SS are fitted in the form of ribands of stout timber and ties TT of steel plates, both sets being strongly bolted to the poppets.

Motion of Vessel During Launch

We do not know that any attempt has yet been made to determine accurately and continuously the exact motion of a vessel from start to finish of her launch. Records have been made of velocity and of the maximum dip of bow and stern. The latter are difficult to observe accurately and are usually referred to the water surface and not to fixed points on shore. But as the water surface is more or less disturbed by the entry of the ship herself, it cannot be said that the maximum immersion of the ship as shown by the rise of the water-line on her side is equal to the maximum depth of her keel below the original still water level. The relation of the keel to the bed of the river is therefore not accurately known. It is of great importance, however, that the maximum immersions should be known, so that sufficient clearance may be ensured between the after end of the keel and the river bed, and between the forefoot and the lower end of the berth. The theoretical or statical dip of stern can be obtained from the calculation table by plotting draught at AP on a base of travel and measuring the ordinate at the point where the stern begins to rise. But the motion of the vessel and alterations in the water level may modify the result in some way which it is impossible to predict. The maximum dip of the forefoot, as stated by Mr. Smith in his paper on camber, can be theoretically obtained by adding to her launching draught the amount which that draught mark is above still water level at the instant when the fore poppet drops off the after end of the ground-ways. But this again assumes statical conditions, and takes no account of inertia, water resistance, or alteration in water level. The bow of the vessel just before she drops is travelling in a direction parallel to the slope of the way ends and has therefore a downward component tending to produce additional dip.

In order to investigate these and similar points of interest we decided in

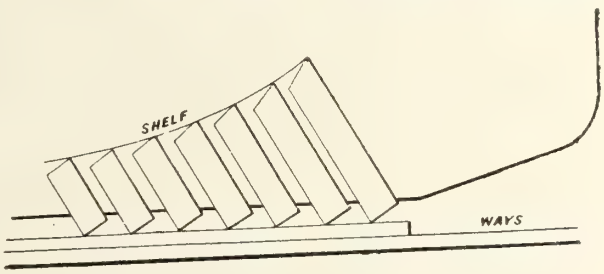


FIG. 24.

the case of an important launch to make a model experiment, reproducing as closely as possible all the essential conditions and recording the whode motion. A large tank was prepared having to scale the shape and depth of the river, and to represent the ways brass rails were laid, having the proper declivity, camber, and relation to tide level. The latter point was not essential—any convenient parallel position would have produced the same results. Brass grooved wheels were fixed to the hull at such intervals as to ensure that she would be properly supported throughout her motion, one pair of course being placed at the fore edge of the fore poppets and one pair just aft of the centre of gravity to ensure that the vessel would not tip when supported only by the ways. To determine the minimum number and correct positions of the remaining wheels we were guided by the fact that in any position the vessel is supported partly by buoyancy and partly by land force supplied by the ways. Let these forces be B and F (Fig. 26), together equal to W, and having equal moments about the vessel's centre of gravity so that Bb=Ff, from which the values of f and h are easily calculated. There must evidently always be a wheel between F and the after end of the ways. On a base line representing travel of fore poppets (Fig. 27) set up a curve representing to the same scale the distance h of the land force from the fore poppet, beginning with the value g′ and becoming zero at the time when the stern rises. Draw also the straight line AEW at 45°, representing for any travel the distance of the latter end of the ways from the fore poppet. Then there must always be at least one pair of wheels between F and AEW. The aftermost pair of wheels is placed at a distance OA from the fore poppet, OA being slightly greater than g′. The horizontal line AA shows the (constant) distance of these wheels from the fore poppet, and this pair will serve to support the vessel until the line AA meets the line AEW, when the wheels pass over the after end of the ways. Shortly before this point is reahed draw a vertical line AB, and place a second poir of wheels at the point B slightly nearer to the stern than the then position of the land force. A horizontal line drawn through B shows that this pair will support the vessel until the stern rises, so that in this case only three pair of wheels are necessary. The matter could be simplified and the number of wheels reduced to three by fixing a central rail to the model and supporting it by a single wheel fixed to the ground at the after end of the ways. The single rail would have to project a distance E beyond the after perpendicular, and care would have to be taken that its end did not touch the river bed at the moment of maximum dip aft. This method would reduce friction to a minimum and get rid of the difficulty of getting six or more wheels to bear simultaneously upon the cambered rails. The centre rail might also be fixed below water in continuation of the curve of the ground-ways and a single wheel fixed to the ship at AP.

It was important that the model should not only be of correct weight, but that the position of its centre of gravity

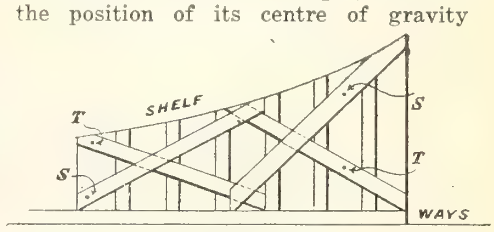


FIG. 25.

longitudinally and its moment of inertia for rotation about a horizontal transverse axis through its centre of gravity should be in agreement with those of the actual vessel. Adjustable lead weights were placed on deck and moved

*Part III. of a paper read before the Institution of Naval Architects, March 29, 1917.

to and fro until the latter two conditions were satisfied. The value of the moment of inertia was tested by bifilar suspension, the model being suspended by two long parallel cords equal distant from C.G., its ends pulled sideways in opposite directions and then released, the model being left free to rotate to and fro about a vertical exis through G. If a be the distance between the cords, l the length of each, and t the observed period for a double swing, then the required radius of gyration—

$$K = \frac{a\,t}{4\,pi} \sqrt{\frac{g}{l}}$$

The velocity of the model when leaving the ways was recorded automatically by a means of clockwork and two electrical contacts made by the moving model. The making of the contracts was marked by pens against a uniform pen-marked scale of seconds upon a moving strip of paper, and from the number of seconds from contact to contact the speed of the model was obtained. It was found that the force of gravity was not sufficient to give the required speed, and it became necessary to accelerate the model artificially. This was done by passing a cord from one side of the tank over a horizontal pulley screwed into the stem, then over a second horizontal pulley on the other side of the tank, and finally over a vertical pulley to a scale pan, all as shown in Fig. 28. By varying the load in the scale pan any desired velocity at the way ends could be obtained.

Drags were represented by small bunches of brass chain correctly proportioned as to weight, and attached to the proper positions on the ship's side by cords of such lengths as to bring the drags into play at the correct successive intervals. A curious fact in this connection was that in order to prevent the vessel from being stopped too quickly it was found necessary to lay sheets of smooth glass below the chains, as the friction between the chains and the wood surface representing the ground of the berth was too great.

Weights were proportioned to cubes, and velocities to square roots, of the linear dimensions.

When all was ready and the tank had been filled with water to the height of the tide expected, several experiments and adjustments were made until correct velocity and movement of drags was ob- with one face vertically over the middle line of the launch, and at the fore and aft perpendiculars of the model two masts were erected, each carrying a pen which traced an ink line on a sheet of paper fixed to the drawing-board. Different colors were used for bow and stern, and before launching the model a

FIG. 29.

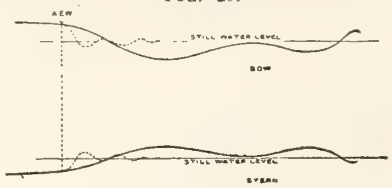


FIG. 30.

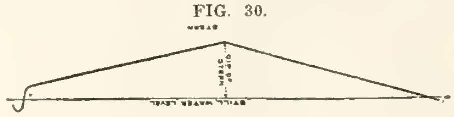


FIG. 31.

level line was marked on the paper by gauge from the still water surface.

A preliminary experiment was made by dropping the bow over the ends of the ways without fore and aft movement, except that produced by the wheels in clearing the way ends. As was expected, the amount of dip below the final still water draught was less than the height of the launch draught mark above water before dropping. The difference represents energy expended in water disturbance, and the ratio of dip to drop was about .35.

When the vessel was moving rapidly off the way ends quite another result was recorded, the dip being about 10 per cent. greater than the drop. This is probably due to several causes—the downward component of the motion of the bow, keeping up a wave aft tending to lift the stern, and the observed fall of the water level at the way ends when the bow dropped. The final result is of great importance, as it shows that more clearance is required forward than has commonly been considered sufficient.

On the dotted line. Fig. 29, shows the bow record obtained when the vessel merely dropped off the way ends without previous motion, while the full line shows the path followed during the experimental launch. Fig. 30 gives the corresponding records for the stern. In Fig. 31, which shows nearly the whole path of the stern, the longitudinal scale been omitted from the figures. Then the stern line begins to rise and the bow to fall, the latter movement being due to the fact that the forward pen was some distance forward of the fore poppet wheels about which the model was rotating. It is curious to note how sharp is the angle between the two phases of the movement of the stern and the straightness of its motion after beginning to rise. When the bow drops the stern rises suddenly, and thereafter both vibrate up and down for some time until the vessel comes to rest.

An accurate record of the complete motion of the actual vessel from start to finish would be of great value, and could, we think, be obtained easily and correctly by means of the cinematograph. Two machines would be required, one placed near the stern of the vessel when on the slip, and the other somewhat less than the length of the vessel farther aft. Both would stand at a convenient distance away from the vessel's side, and would have their axes at right angles to the middle line of the berth. In the field of view of each, two uprights would be placed as near to the vessel's side as possible, and on each upright a vertical scale of feet would be clearly marked in black and white. On the ship's side would be painted a continuous longitudinal white line crossed by short vertical lines numbered in succession from either end. As the vessel moved the cameras would record continuously the movements of the white line in relation to the two fixed scales on the uprights, and from the known positions of the lines photographed in relation to the ship and to the water level and groundways, the whole motion could be reconstructed. If, in addition, there could be placed in front of each camera a large clock-face with seconds pointer, the two sets of photographs could be correlated and a record of velocities obtained.

RECENT LOSSES FROM SUBMARINES AND MINES

ACCORDING to a statement given out on July 18, fourteen British ships of over 1.600 tons were sunk by submarines or mines in the week preceding. Four British vessels under 1,600 tons were sunk, as were also eight fishing craft. The official report is as follows:—Arrivals, 2,828; sailings, 2,920; British merchant ships sunk by mine or submarine, over

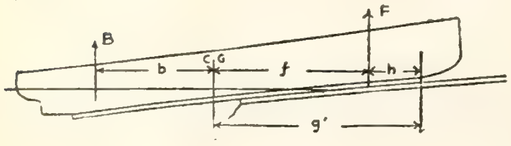


FIG. 26.

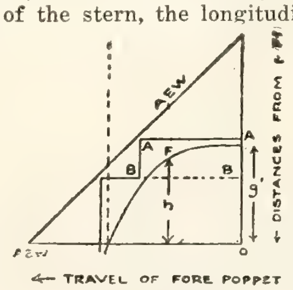


FIG. 27.

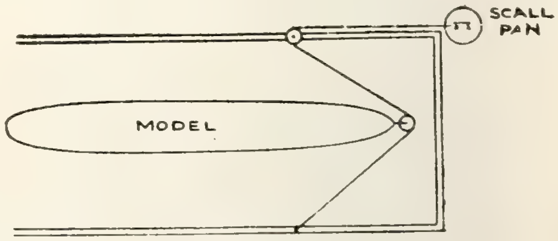
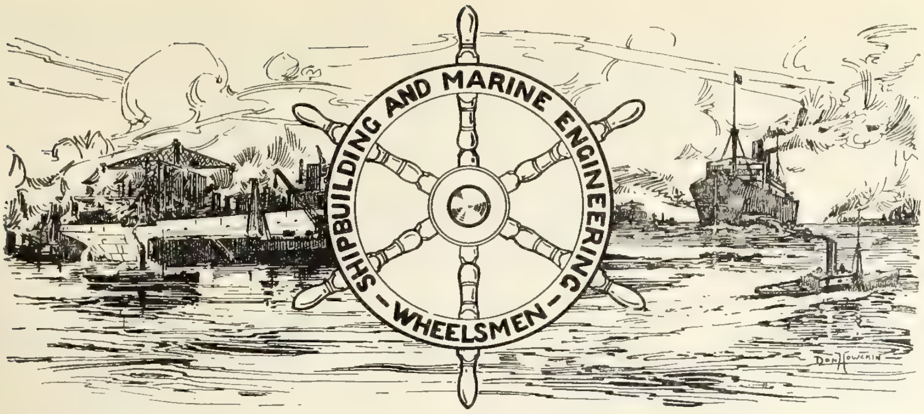


FIG. 28.

tained, and it was found that these results could be correctly repeated as often as desired.

To record the exact motion of the vessel a long drawing-board was placed has been contracted in order to keep the lines within reasonable limits for reproduction. At first both bow and stern lines follow the camber and declivity of the ways, and most of this portion has 1.600 tons, and including one previously, 14; under 1,600 tons, 4; British merchant vessels unsuccessfully attacked, including three previously, 12; British fishing vessels sunk, 8.



The success of shipbuilding and marine engineering enterprise is largely dependent on its "Wheelsmen." This series of articles has for its object the featuring in a racy, interesting and instructive fashion, the personal training, experience and achievement of those who to-day in Canada are energetically and effectively navigating the twin craft to higher degree prominence in their capacity as designers, constructors, outfitters, etc.

GEORGE CHADWICK GREGSON

ON the seaward side of the hammer-shaped peninsula, forming part of the district of Furness, between the estuary of the Duddon and Morecambe Bay, where a narrow channel intervenes between the mainland and the long low Island of Walney, is the small but thriving town of Barrow-in-Furness. This sea town is noted for its modern and remarkable growth during the past century. The growth has been dependent primarily upon the existence of veins of pure haematite iron ore in the adjacent district. Early in the nineteenth century, mining operations were in progress, and the subsequent development was so rapid that the export of ore in 1847 amounted to 50,000 tons per year, the town at that time having a population of about 325. Some few years later, large iron works were erected, to be followed shortly thereafter by other industries. The location being a highly desirable one for shipbuilding purposes this industry soon surpassed all others, and now occupies the foremost place in the town's activities. The yard of the celebrated firm of Vickers, Ltd., is located here, and from the human element of this plant our "Spoke" for this issue received his training.

Education and Apprenticeship

George Chadwick Gregson, superintendent of the munitions department, Canadian Vickers, Ltd., Montreal, was born in Barrow-in-Furness, Lancashire, England, on December 10, 1886; his father being Robert Gregson, master mariner, and his mother Georgina Agnes Chadwick. **Having come from a long line of sea-going ancestors on his father's side, it was the early ambition of our "Spoke" to cast his lot upon the briny deep, but a combination of circumstances willed it otherwise. George received his boyhood education at the High Grade School, Barrow-in-Furness, and at the age of fifteen started his apprenticeship with Vickers, Sons and Maxim, naval constructors, in the gun mounting department.** The first three years were divided between bench, marking-off tables, tool and jig drawing office, and assembling of heavy guns on ships, the last two years being spent on the machines, principally lathes. Much of the success of our youthful "Spoke" is attributed to instruction given at the excellent local technical school in which the firm took special interest, encouraging the boys in every way to attend regularly. Boys who did well at the night school had their hours of work shortened, were granted

GEORGE CHADWICK GREGSON

bonuses, and, if so inclined, were given positions in the draughting offices.

Old Country Apprenticeship Practice

Boys of to-day apparently do not realize the difficulties contingent to the serving of an apprenticeship in British industries, and probably would not relish the early hours of rising, that is the general practice in that country. Living some distance from the works and being required to start at 6 a.m., it was necessary that our "Spoke" should "get up" at five in the morning to answer "roll call"; and to his credit be it said, that he was not late more than half a dozen times during the five years of his apprenticeship. In addition to this, George was a regular attendant at night school, two to three nights a week, acquiring the fundamental essentials in steam, machine construction and drawing, mechanics and mathematics, in order to establish himself in the theory of his practical accomplishments.

Promotion Rapid

Honest effort is always rewarded, and a few weeks after the completion of his apprenticeship, the subject of our sketch was called into the office of Mr. Fender, works superintendent, and asked if he would like to go on his rate-paying and efficiency staff. This new departure was to the liking of our "Spoke," and for six months he was estimating and fixing prices in the Field Carriage Department, following which he was promoted to be assistant foreman in the same department. Realizing his abilities, the management transferred him to the shipyard, where for twelve months he was engaged in fixing prices and looking after costs on all ship fittings. Similar positions were filled in the Marine Engine Department, fixing prices on all classes of machinery; the same duties in the large turbine erecting pits, and at the same time looking after the cylinder and shafting shops. During his sojourn in this latter department, the engines of the large battle cruisers, Lion and Princess Royal, were under construction, these consisting of turbines developing 75,000 horse-power; also those for the Japanese battle cruiser, Kongo, of 80,000 rated horse-power. Trouble having arisen in connection with the maintenance of the heavy oil engine department, our "Spoke" received instructions to establish order there, as a result of which he gained further new and interesting experience. During the seven years that followed his apprenticeship, he covered all the machining and assembling sections of the works, which at that time was employing from 18,000 to 20,000 men, and which has justly earned the reputation of having the most satisfactory and complete cost and process system in the world; that is, for a plant of its size and character. A constant source of inspiration to the members of the rate fixing staff was the opportunity given to study the editorial contents of various trade and technical periodicals, the firm supplying these, as a result of which tool and jig design were in many cases materially influenced.

Accepts Position in Canada

While still in the heavy oil engine department, our "Spoke" was approached by the Ingersoll-Rand Co., of Sherbrooke, Que., with a view to accepting a position to assist in establishing a planning and efficiency department. Negotiations being satisfactorily arranged, G. C. G. came to Canada in the spring of 1913 and

spent two pleasant and instructive years, the experience gained being of inestimable value. In March of 1915, our "Spoke" again returned to Vickers' employ, this time, however, to the Canadian plant at Montreal, P.Q. At this time the manufacture of munitions was occupying the attention of many Canadian industries, and our "Spoke" was given the position of superintendent of a shell shop which was just being inaugurated. Much of the success of Canadian Vickers, Ltd., during the past two years of shell activity can be credited to the untiring efforts and executive ability of Mr. Gregson, although he admits that he has thought, many a time, that his friends would be visiting him in Verdun. (There is a place there where the guards do your thinking, and entertainment is supplied by the Government.)

Travel, Recreation, and Social Side

Whether G. C. G. is a believer in the adage that "A Rolling Stone Gathers no Moss," is not known, but at any rate his traveling has been confined to a few trips to the States on the lookout for machinery. However, the call of his forefathers is still heard, and during his summer holidays, particularly before coming to Canada, he spent his recreation periods upon the deep blue sea. He remembers with pleasure that a few years back he used to pack his "sea bag," go over to Fleetwood, and ask some trawler skipper if he would take a passenger, the answer generally being favorable to our "sailor's" ambition. Many a two weeks were spent in this way, either on the South Coast of Ireland or to the lonely rock of Rockwell, on the West Coast of Scotland. Being an Englishman, G. C. G. is also passionately fond of walking, and in pursuit of pleasure he has walked over many portions of England, Ireland and Wales.

Early in 1914, eleven months after his arrival in Sherbrooke, P.Q., Mr. Gregson married Mary Constance Vernon, youngest daughter of Mr. and Mrs. J. W. Vernon, of London street, Sherbrooke. George's wife is a Canadian, and a great booster for this country, her mother's name being Bliss, and one of an old Eastern Townships family. The present residence of our "Spoke" is at No. 22 Third Ave., Montreal, about three minutes' walk from the plant; this feature during the past two years proving especially handy when it is necessary to be called to the works at all hours of the day and night.

Views on Technical Study

In religion, Mr. Gregson is an Anglican, and in politics (English), was a Liberal; but the strenuous times of the past few years has given little opportunity to declare himself in this country. Mr. Gregson, when time permits, uses his recreation hours in cricket, football, tennis, and fishing.

Speaking of the advantages of technical study on the part of young mechanics, Mr. Gregson says: "In my opinion, the technical papers have, and are, playing a very important part in the development of the modern machine shop; in their pages one sees all that is new; you are brought into contact with what is going on in other shops throughout the country. Many and many a time we have just got the idea we wanted by running through a bundle of technical papers in search of a simple jig, or inexpensive and quick production tool. The idea of a jig and tool designing office without these journals is too ridiculous to think of. If the young mechanic of to-day has any ambition outside of being just a good mechinist, he has simply got to study, and study hard. These are days of keen competition, and the man who has a little more knowledge than his fellow, and the ability to use it, is the one to gather the plums."

BOILER RIVET HOLES AND RIVETING

RIVETING is now generally done by hydraulic machines, which have shown themselves superior to any other kind. In consequence of the slow movement of a hydraulic plunger, the rivets have time to enlarge and fill the holes; and from the solidity of action and steady holding power of the machine the plates are firmly pressed together, with the result that joints riveted by this type of machine are tighter than those made by any other.

It is a common practice to punch the holes of boilers ⅛ in. or ¼ in. small and then to drill them to size with all plates and covering strips in place. This is a great advance in practice over punching to size, but it is not satisfying to the imagination, and it may be one reason why plates exposed to the hottest gases crack between the rivets and their edges. Another reason for such cracking may be bulging caused by too much pressure by the riveting machine on the rivet. Sometimes such bulging is very apparent. A still further advance in practice is to punch one butt strap for each joint with small holes and use it as a template for drilling not only itself but the main plate and the other butt strap. Similarly, the holes in one plate of a circular seam may be punched small and used for a template for drilling the other holes. The best way, however, and the one which should be adopted everywhere, is to drill all holes from the solid.

HIGH VACUUM CONDENSERS

IN purchasing high vacuum condensers, comparison should be made of the pneumatic resistance of the structures on the basis of velocity of flow at each row of tubes and the number of rows in series through which steam must flow. Attention should also be given to possibilities for the formation of air pockets out of the line of flow, considering both transverse and longitudinal sections.

The highest coefficients of heat transmission are obtainable in condensers of moderate size in which the smaller depth of tube bank lessens the pneumatic resistance.

The depression of the air suction temperature below the inlet vacuum temperature is an index of the surface efficiency on the steam side.

By analyzing the temperature depression in a given condenser into that due to pressure drop and that due to partial air pressure, it is possible to determine whether flow conditions or air conditions offer the greater possibility for improving efficiency and vacuum.

By means of accurate electrical resisance thermometers, temperatures can be taken at a multitude of points on both steam and water sides of the surface of a condenser undergoing changes in operating conditions, which would enable one to isolate the factors influencing the extent of the active and inactive zones.

A high velocity of circulating water, or the equivalent increase in water film agitation by the use of cores or spirals, is desirable in the tubes of the active zone of a condenser, and this can be obtained, without additional power consumption in pumping the circulating water, by reducing the velocity of the water through the tubes of the inactive zone.

MONTREAL INTERESTS ACQUIRE WOOD SHIPBUILDING PLANT

A GROUP of Montreal capitalists, including William Lyall, president of the P. Lyall & Sons' Construction Co.; H. W. Beauclerc, a Lyall director, and others of their associates, have acquired the wooden shipbuilding branch of the Wallace Shipbuilding Co.'s business at Vancouver, B.C., and will at once incorporate a new company to carry on the business. The company will have a Dominion charter. The negotiations were recently concluded at Vancouver by Mr. Lyall, who had been at the coast for some time going into the matter. The purchase price has already been paid over. This is a going concern, with a number of vessels now under construction.

Accompanying Mr. Lyall were two representatives of the Imperial Munitions Board, who have satisfied themselves as to the company's ability to build ships, and a contract for several vessels for the British Government has already been closed. These vessels will be of the standardized 3,000-ton type already being built on the coast. They will cost approximately $400,000 each, and the company expects to be able to turn out a number this year. The property purchased from the Wallace Co. includes three shipbuilding slips, and three more will be constructed, so that several vessels may be building simultaneously.

The new company has an experienced staff of experts engaged for the more responsible positions.

"An Irish hostess, when she asks if you'll have sugar in your 'tay,' holds out the bowl and absent-mindedly goes on with her conversation, allowing you to help yourself.

"An English hostess asks, "One lump or two?' and carefuly drops the sugar into your tea.

"If you should ask a Scotch hostess for a little more sugar in your tea, she would demand, with a note of surprise, 'And hae ye stirred it yet?'"

Merits of Some Recent Developments in Air Pump Design*

By E. Jones

In this paper there are discussed the merits of some of the more recent developments pertaining to a piece of equipment installed in most power stations. An air pump is a very essential part of the condensing plant, without which any of our modern steam-operated power stations or, indeed, any machines used for the generation of power, employing steam as the working fluid, would be practically of no value except for very small units.

It may be advisable at the outset to run very briefly over the various types of condensing plant at present in use, in order to arrive at the cause of inventors turning their attention to the design of new types of air pumps. There are five types of condenser, viz., evaporative, ejector, barometric, jet, and surface.

Evaporative Condenser

Evaporative condensers are expensive because of the large cooling surface re-

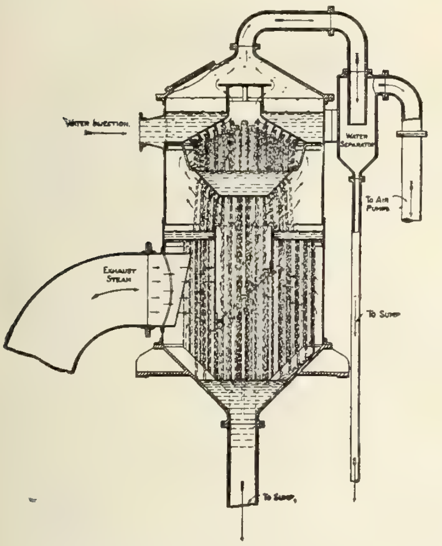


FIG. 1. TYPICAL BAROMETRIC JET PLANT.

quired to condense the steam, and are only adopted when it is almost impossible to obtain water which can be utilized for cooling purposes. Steam flows inside of the tubes, which are grouped together in sections, and all joined up to the header pipes or steam mains. Cooling is obtained by air, and the radiation effects caused by allowing a stream of water to continually pass over the tubes. There are a great many joints in the apparatus which tend to make this type of condenser unsuitable for modern requirements.

Ejector Condenser

The ejector condenser deals with the steam and air without the use of an air pump. The steam to be condensed is delivered into the condenser body, which is fitted with a specially designed series of nozzles. The cooling water enters under pressure at the top of these nozzles, condensing the steam and entraining the air and incondensable gases, the whole passing down the discharge pipe. Despite the simplicity of these condensers, they do not appear to have found general favor.

The foregoing types would appear to be still in the embryo stage, and open up large fields for further investigation.

Barometric Condenser

The barometric condenser is, of course, a jet condenser, in which the cycle of operations of the cooling water is just the reverse of the cycle used in the low-level jet plant—that is to say, the cooling water is pumped into the condenser and flows away by gravity down the tail pipe. It is, therefore, necessary to place this condenser at a height above the level of the water in the outlet sump, equal at least to the height of the water column which could be supported by the vacuum plus a marginal head of at least 3 ft. or 4 ft., to allow for pipe friction and to cause flow of the water. This very often means that the condenser has to be placed on the top of a building, or on a staging specially erected to accommodate it at the required height. Occasionally cases crop up where a barometric plant can be installed at the ground level of the engine room, but this means that the cooling water is at a level of at least 34 ft. below, and, therefore, if the pumping plant is of the centrifugal type, it is necessary to have a pump house considerably nearer the cooling water level, which means that the plant is not compact or self-contained. This is a decided disadvantage. Another point which does not tend to add favor to the barometric plant when placed at a distance above the exhaust branch of the prime mover is the long length of exhaust steam main, which is not only expensive, but often a source of trouble, due to the greater number of joints, which have to be kept perfectly air-tight.

Low Level Jet and Surface Condensers

It is chiefly for these reasons that the barometric jet-condensing plant has been superseded by the low-level jet plant. At the present time the majority of condensing installations are either of the jet or surface type, and the choice generally depends on local conditions and sometimes by the amount of money available for the scheme on hand. With the low-level type of jet plant, the cooling water is drawn into the condenser which is under vacuum. The water and steam mix freely, and the latter is condensed, and the cooling water and condensate are extracted from the condenser by means of a pump which is invariably, as far as the writer's experience goes, of the centrifugal type, specially designed to meet the requirements of drawing water from a space under a very low absolute pressure and discharging at atmospheric pressure or against an external head. The air and gases which are not liquefiable under the conditions obtaining in the condenser, are dealt with by some type of dry air pump. The advantages of this type of plant over the barometric jet plant are that it can be placed immediately below the turbine, thereby reducing the possibility of air leaks. The whole equipment is self-contained and compact, and can be operated and regulated at very short notice by the engine-room attendant. Fig. 1 and 2, show a typical barmetric jet plant and low level multiple jet plant of the Leblanc type.

Surface Condenser for Marine Work

Perhaps the most important type of condensing plant is the surface condenser, inasmuch as it is used almost invariably for marine installations, and in a lesser degree for large power units, the reason for this being that the condensate is an important item, as it supplies a source of excellent boiler feed-water and also under the same external conditions, the power required to operate a surface condensing plant is generally less than for a jet plant. The design of modern

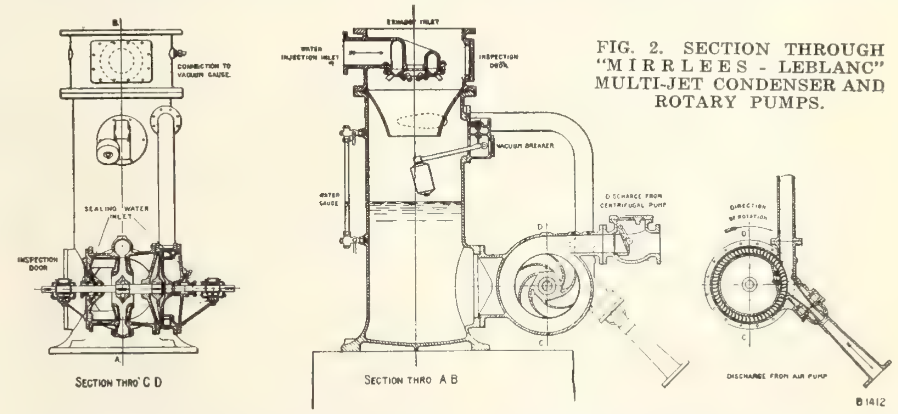


FIG. 2. SECTION THROUGH "MIRRLEES - LEBLANC" MULTI-JET CONDENSER AND ROTARY PUMPS.

*From a paper read recently before the Institution of Engineers and Shipbuilders, Glasgow, Scotland.

surface condensers, as far as the condenser itself is concerned, has not changed materially for the last 30 years or so, so that there is no need to go are as follows:—Steam quantity 40,000 lbs. per hour, vacuum 28½ inches (barometer 30 inches)—95 per cent. of the barometer, cooling water 60 deg. Fah.,

Type of plant.	Consisting of—	Approximate net weight of apparatus.	H.P. required to drive condenser and auxiliaries.	Present day costs.	Equivalent ratio.
Barometric.	Condenser, staging, air-pump, injection pump, driving motor, switchgear, air and tail piping, main-exhaust piping and sluice valve, auto-exhaust valve. Complete erection.	40 tons.	89 B.H.P.	£2,700	1·286
Low-level jet.	Condenser, water-extraction and air-pumps, driving motor, switchgear, main sluice-valve, adapting and expansion pieces, auto-exhaust valve. Complete erection.	22 tons.	87 B.H.P.	£2,100	1·00
Surface.	Condenser, rotary air-pump, extraction pump and circulating pump mounted on common bedplate with driving motor and switchgear. Necessary interconnecting pipes, main exhaust steam-sluice-valve, expansion piece, adapting piece, automatic atmospheric-valve. Complete erection.	30 tons.	78 B.H.P.	£3.300	1·571

FIG. 2a. RELATIVE COSTS AND REQUIREMENTS OF THE FOREGOING THREE TYPES OF CONDENSERS.

further into details on this point. The cooling water is usually supplied by means of a centrifugal pump, except in cases where a syphonic action can be utilized or where the existing pumping plant is capable of taking care of the requirements of the condenser. A condensate pump is necessary to deliver the condensate from the condenser to the boiler feed-tank, and a dry air-pump to deal with the air and unliquefiable gases which find their way to the condenser. Alternately, an Edwards air pump can be adopted to deal with both the condensate and air. If the disposition of the various parts of the installation demand it, a hot-well will also be required. The above table may be of interest in noting the relative costs and requirements of prime mover, high pressure steam turbine. For the barometric plant, .25 inch has been added to the vacuum to allow for the drop between the turbine-exhaust flange and the condenser. It should be noticed here that under the present abnormal conditions, surface condensers are in a practically unfortunate position, owing to the cost of the materials used for the tubes and tube plates, which is approximately 27½ per cent. of the value of the whole equipment. The price of tubes to-day is 38 cents per lb., whereas, in 1914, just prior to the commencement of the war, the price was 15 cents per lb., so that the increase in the cost of tubes is 240 per cent., and the increase in the cost of plates is approximately the same. Therefore, if times were normal, surface-

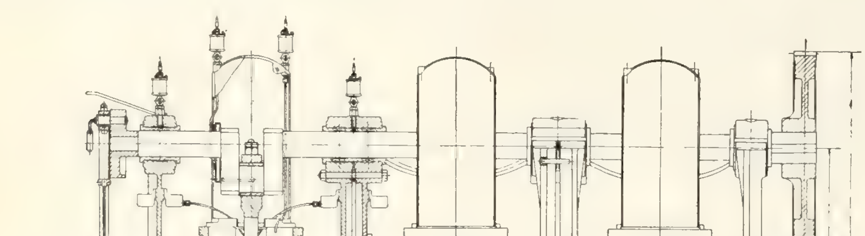


FIG. 3. SURFACE CONDENSING EQUIPMENT SHOWING SECTION THROUGH "EDWARDS" AIR PUMP.

the last three types of condensers which have been considered.

The conditions which have been assumed are the same for each case, and condensing equipment would appear in a much better light, and although it is not proposed to suggest an accurate figure for surface plant with tubes at 15 cents, it is clear that a reduction of from $2,500 to $3,000 should be possible in the case given above. This would bring the cost ratio of the surface plant, when compared with a multi-jet plant, from 1.57 to about 1.3.

With the earliest types of surface condensing equipment, it was usual to use one pump for removing both the condensate and air from the condenser. This pump was known as a "wet" air pump, and a good example of this type is the Edwards air-pump, one of the most efficient of its class. It is shown in section in Fig.3. The chief advantages of this type of pump are:—Low power required for driving; positive action and consequent stability; ability to cope with excessive air leakages. While the Edwards pump is still an excellent pump for units up to, say, from 3,000 to 4,000 k.w., it must be remembered that, with the ever-growing size of power units, its disadvantages should be kept in view. For large units with Edwards pumps, it

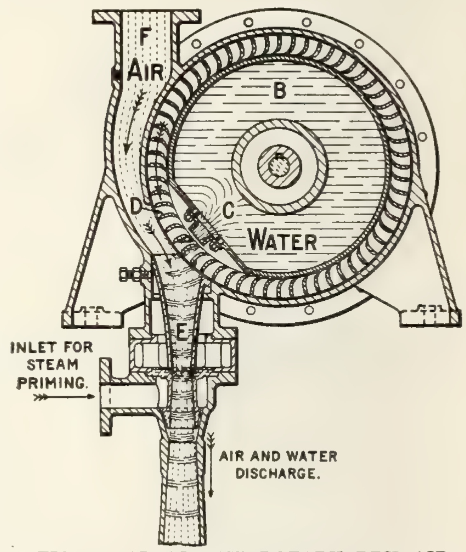


FIG. 4. "LEBLANC" ROTARY DRY AIR PUMP.

is necessary that they should run at a very low speed, and consequently they are very cumbersome, and take up a large amount of floor space. With jet plants, the Edwards pump is sometimes used as a dry air-pump. It is necessary, of course, to provide a small quantity of water for sealing purposes. Volumetric efficiency in this pump varies considerably with the degree of vacuum required, and decreases as the vacuum increases from about 50 per cent. at 3½ inches absolute pressure to 18 per cent. at 1 inch absolute pressure.

Dry Air Reciprocating Type Pump

Another system is that in which a dry air-pump of the reciprocating type is used to remove the air and uncondensed gases, and a separate pump to remove the condensate. The advantages and disadvantages of this system are the same as for the Edwards air pump, but the efficiency is rather better. Previous to the introduction of the steam turbine, condensing plant equipments were furnished with air pumps of one or other of the types mentioned above, but as soon as the turbine became a commercial pro-

position, it was necessary to look for a type of pump having features specially adapted to its requirements. With turbine installations, it is essential to use a high vacuum in the condenser, whereas

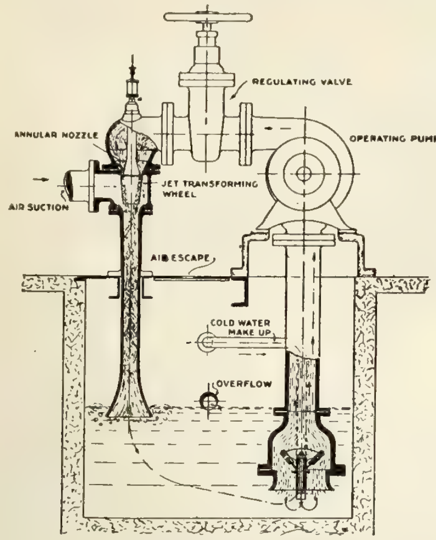


FIG. 5. HYDRAULIC VACUUM PUMP ON EJECTOR PRINCIPLE.

with steam engines of the reciprocating type a vacuum of more than 26½ inches was seldom required. In fact, it is questionable whether using a higher vacuum than 26½ inches would not be considered a disadvantage. With the turbine, however, a vacuum less than 27 inches is rarely asked for, and sometimes the specified figure is as high as 29.25 inches with the standard barometer reading of 30 inches.

In considering these figures, due allowance must be made for the altitude of the place. The most economical vacuum for a turbine installation depends on a variety of things, and each case has to be considered on its merits. On reference to steam tables it will be seen that an increase in vacuum from 27 inches to, say, 29 inches, other conditions as air leakage remaining the same, necessitates an increase in the capacity of the air pumps from 1.00 to 3.25, which for a large installation with Edwards or reciprocating dry air pumps is a very serious

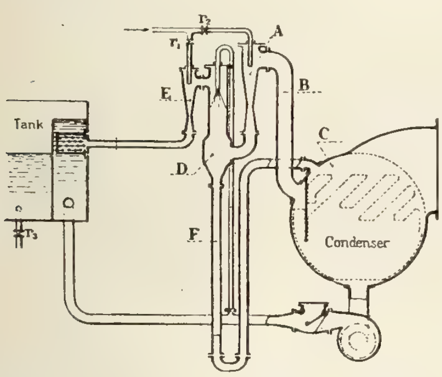


FIG. 6. EJECTOR AIR PUMP CONSISTING OF TWO EJECTORS WORKING IN SERIES.

matter. Hence it is that various types of rotary pumps, which are specially suitable for dealing with large volumes of air at low tension, have been designed since the adoption of the steam turbine, several of which have proved very successful. The general design of these pumps is much the same, in so far as they use a certain quantity of what is termed "operating water," for which various devices have been invented to cause this water to move in such a manner as to entrain the air from the condenser and discharge it to the atmosphere.

Leblanc Rotary Dry Air Pump

Perhaps one of the best known rotary dry air-pumps is the one invented by Prof. Maurice Leblanc. It has been used to a very large extent all over the world and its action is shown in Fig. 4. This pump is capable of maintaining a very high vacuum, and for this reason, coupled with the fact that it is very simple in construction and not likely to get out of order, it has been largely used for turbine installations. It cannot be claimed for this pump—or indeed for any type of rotary air-pump—that it can successfully deal with an excessive air leakage, but consideration will show that this quality is not essential in the case of turbine installations where air leakage is reduced to a minimum by the adoption of steam or water-sealed glands where the shaft passes out of the turbine casing. With a surface-condensing plant, it is only possible for air to be brought into the system by the feed-water and carried over with the steam, or by leaking in at the joints. With jet plants, the air brought in with the injection water has to be allowed for in addition to the above, and it is for this reason that the air-pump on a jet plant requires to be larger than that for a surface-condensing plant doing the same steam duty.

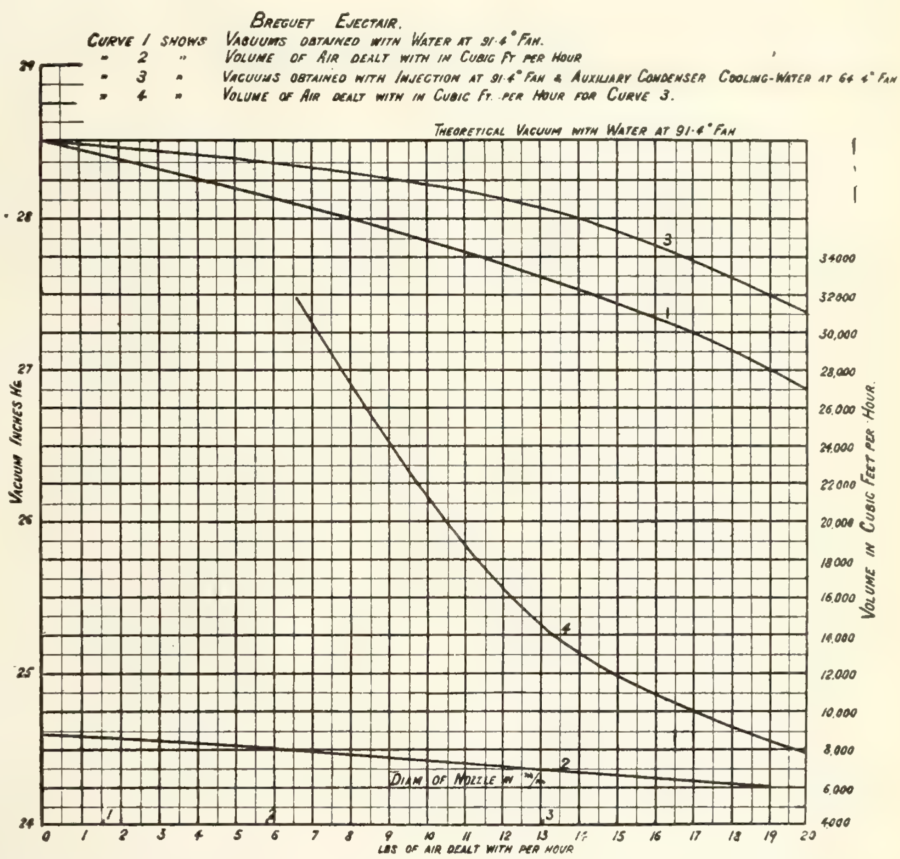


FIG. 7. PERFORMANCE DIAGRAM OF "EJECTAIR," OR EJECTOR AIR PUMP.

The power required to drive these pumps is rather higher than that required for an Edwards or other good type of reciprocating air-pump, and consequently a good deal of attention has been paid recently to another type of pump which would incorporate the simplicity and compactness of the rotary pump and the low-power consumption of the Edwards and other reciprocating pumps. The general trend of thought seems to have been in one direction, and there are now on the market, and in commercial use, air-pumps operating on the ejector principle. Nearly all the leading condenser manufacturers now construct air-pumps of this description.

Worthington Hydraulic Vacuum Pump

The Worthington Pump Co. manufacture a patent hydraulic vacuum pump on the ejector principle, as illustrated in Fig. 5, which consists of the injection head, the air-suction chamber, the rotary wheel, and the throat and tail pipes. The operating water passes between two nozzle rings, and the cone of water passes between the body of the wheel and the outer sleeve, impinging on the inclined surfaces of the vanes, thus imparting a rotary motion to the wheel. To operate the pump, it is necessary to provide a certain amount of sealing water, which is supplied from a tank situated as convenient as possible to the pump. The sealing water takes up a certain amount of heat from the air and water vapors withdrawn by the air-pump, and a piping arrangement is provided for withdrawing a certain amount of this water by means of a by-pass connection on the operating pump discharge,

this by-pass being fitted with a controlling reflux valve. The quantity of water withdrawn in this manner is replaced by make-up water drawn from the circulating inlet piping or an independent supply, thus cooling the water used in the cycle of operation. This apparatus is doing regular service on one of the turbo-alternator groups at the Glasgow Corporation power station at St. Andrew's Cross. A number of installations have also been supplied to other concerns.

Willans-Muller Ejector Air Pump

Willans & Robinson, of Rugby, manufacture the Willans-Muller ejector air-pump, which is operated by the circulating water, either on the series or shunt system. With the series system, the whole of the circulating water passes through the ejector before entering the condenser. With the shunt system, only a portion of the cooling water passes through the ejector, which, after use, is returned to the pump suction or the source of supply. A third method of operating this ejector is by the separate pump system, in exactly the same manner as described with reference to the Worthington pump. The Glasgow Corporation have a set of this apparatus at work at Pinkston Power Station, and good results have been obtained, and a second set is just being installed at St. Andrew's Cross.

Hick, Hargreaves "Ejectair"

Another type of ejector air-pump is that manufactured by Hick, Hargreaves & Co., Bolton, under license from the Maison Breguet, Paris, which is really two ejectors working in series with an auxiliary condenser placed between the first and second stage of the ejectors. A number of these air-pumps, termed "Ejectairs," have been supplied or are under construction for the French navy. Referring to Fig. 6, it will be observed that the primary ejector is placed in direct communication with the main condenser, and extracts the aerated vapor, being operated by a single steam jet or nozzle. The mixture of steam and partly compressed vapor is then discharged to the auxiliary condenser, and the water returned to the main condenser to be dealt with by the extraction pump. The second stage ejector is coupled up to the auxiliary condenser, and draws the air away, discharging it to the feed-tank. An automatic air-inlet valve is fitted to the auxiliary condenser, to regulate the absolute pressure therein. It is claimed that taking air from the atmosphere in this manner materially assists the stability of the plant, and also renders it more flexible.

These ejectairs are designed for working with steam pressures at 55 lbs. per square inch or above, and, with a special arrangement of nozzles, lower pressures can be used in the primary ejector, although the advantage of this is not apparent if it is impossible to work the other ejector under the same conditions, neither is it clear whether this can be accomplished or not.

The curves, Fig. 7, show the performance of an ejectair. Steam to the ejectors had an absolute pressure of 125 lbs. per square inch, and the steam consumption is given as 194 lbs. per hour, of which 129 lbs. are recoverable. The apparatus, worked in conjunction wit a small jet condenser, dealing with 94 gallons of injection water per minute.

Curve 1 gives the vacuums obtained with water leaving the condenser at a temperature of 91.4° Fah. (33° C.), and the auxiliary condenser out of action; Curve 2 the volume of air dealt with in cubic feet per hour; Curve 3 the vacuums obtained with given air leaks, and the water leaving the main condenser as for Curve 1, but with the auxiliary condenser supplied with cooling-water at 66.2° Fah. (18° C.), and Curve 4 the volumes of air dealt with under the same conditions. It was caluculated that the air coming in with the injection-water and at leaky joints amounted to 1.10 lbs. per hour (.5 kg.).

Leblanc Ejector Air Pump

The British Westinghouse Electric & Mfg. Co., Manchester, and Mirriless Watson Co., Glasgow, manufacture an ejector air-pump, under license from the Societe Anonyme Westinghouse, Paris and Le Havre, which is another invention of Monsieur Maurice Leblanc. It is the outcome of many months of arduous research work, during which time innumerable difficulties were surmounted by the inventor, with the result that a really first-class ejector air-pump has been evolved. Figs. 8, 9 and 10 show the general layout of the apparatus.

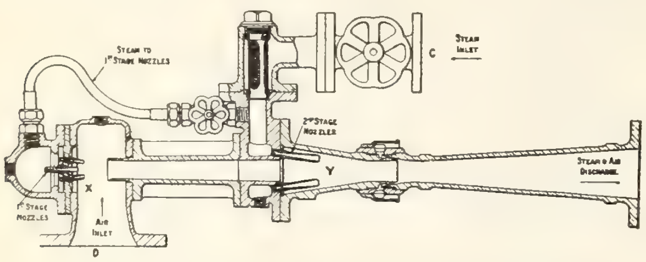


FIG. 8. "LEBLANC" EJECTOR AIR PUMP—SECTION 1.

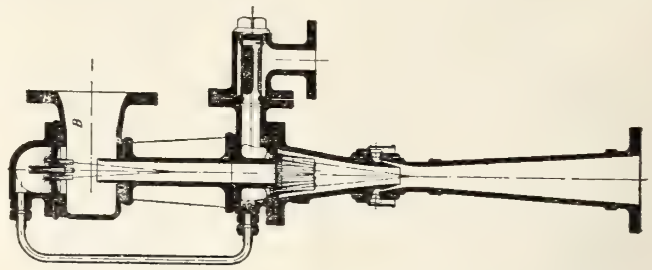


FIG. 9. "LEBLANC" EJECTOR AIR PUMP—SECTION 2.

The pump is arranged to work in two stages, and the steam is admitted to the second stage of the ejector by opening the stop valve. Immediately it is opened, steam fills the annular space behind the nozzle plate, and finds its way into the throats of the group of nozzles attached to this plate; it then passes along the steam pipe which supplies the first-stage nozzles, which are also attached to a nozzle plate. The supply of steam in this set of nozzles is controlled by the stop valve on the steam-supply pipe. The pump is connected to the condenser at the branch, which is the air-inlet branch.

At the entrance to each of the steam spaces, fine wire-gauze strainers are fitted to prevent any foreign matter which may have primed over with the steam from the boilers, from entering the nozzles, thereby intercepting any stoppage in the nozzle throats, and consequently a loss of vacuum. These nozzles are efficiently locked to the nozzle plates. The mixture of air and steam is discharged at the mouth of the divergent cone, and led away to the boiler feed tank, so that the heat units contained in the operating steam can be reclaimed by heating the feed-water. To start the pump to work, it is only necessary to open up the steam valve, and the vacuum will at once commence to increase in the condenser or other vessel to be evacuated. When the vacuum gauge becomes sta-

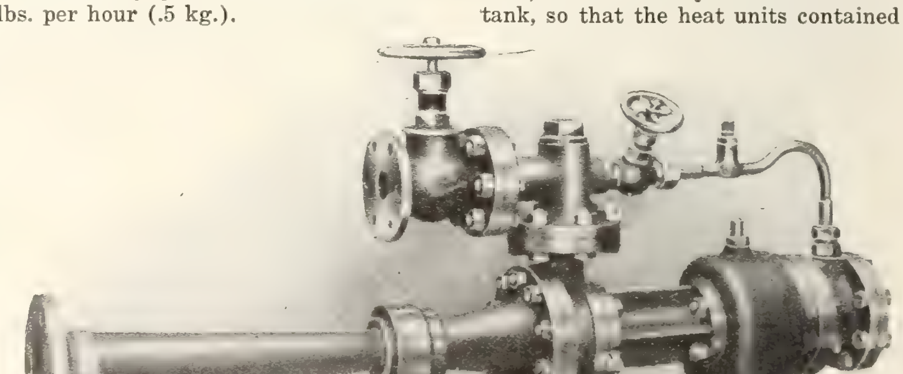


FIG. 10. "LEBLANC" EJECTOR AIR PUMP—EXTERIOR VIEW.

tionary, the second-stage steam-inlet valve is opened up to bring the vacuum to a maximum. A very important feature in this pump is the absence of moving parts. The simplicity of the apparatus is even more remarkable than that of the Leblanc rotary pump.

Advantages of Ejector Air Pump

The advantages claimed are as follow:—Extreme simplicity; the small amount of energy required for operating purposes; the high efficiency obtained; ease with which starting can be effected, and the small amount of attention required whilst at work; ability to produce the highest possible vacuums; stability. In scanning these claims we can pass over the first, which has already been mentioned and is obvious; there are simply two steam valves to open. The second deserves some consideration. The operating steam in passing through the nozzles decreases in pressure, and consequently in temperature, and also, after passing through the nozzles, does work in accelerating the velocity of the air, increasing its temperature and compressing it. There is also a small amount of heat lost, due to friction in passing through the diffuser portion of the ejector, which might be considered negligible. Beyond this, the whole of the heat in the steam can be utilized to heat up the boiler feed-water, and in order to obtain full benefit from the apparatus, it is highly desirable to use the discharge from the ejector for heating purposes of some description. Thus, both the steam and air can be made to do useful work. In view of this, it must not be forgotten that when an ejector of this type is specified as requiring so many pounds of operating steam per hour, this is only the apparent quantity, the actual quantity is really far less, since the great majority of heat units in the steam are still available for further work. The actual heat units recovered can easily be calculated from steam tables, since it is known that the steam and air leave the ejector at a pressure of from 10 to 12 lbs. per square inch by gauge.

Auxiliary Condenser Not Required

It will be observed that with a Leblanc multijector, an auxiliary condenser is not required, and in this respect it differs materially from the "Breguet" ejectair. The employment of an auxiliary condenser has the disadvantage that the total heat units of the steam used in the first-stage ejector, which amount to an appreciable percentage of the total heat units used on the whole apparatus, are dissipated and lost. The makers give this percentage as about 33. Another reason for dispensing with the auxiliary condenser will be apparent from the following:

In all steam-operated ejectors, one of the difficulties that have to be contended with is the fact that the steam leaves the nozzles at a velocity varying from about 3,000 to 3,600 feet per second, while the velocity of the fluid to be entrained is practically nil. This is the cause of considerable loss of efficiency in any ejector, but if an auxiliary condenser is used, the defect is doubled, because the velocity of the fluid to be entrained, which has been imparted to it by the operating steam during its passage through the first-stage ejector, is dissipated and lost as soon as it enters the condenser. The cooling water used on the auxiliary condenser has to be dealt with by the condensate pump, thus increasing the power absorbed by the plant. When working with surface condensers this water must be of good quality, as it has to be returned to the boilers.

The third claim relates to efficiency. It is well known that ordinary single-stage

FIG. 11. STEAM NOZZLE DIAGRAM.

ejectors only work well when the compression ratio is as 1 : 7, and it is partly for this reason that the Breguet Co. have introduced the auxiliary condenser, so that the vacuum obtaining in this condenser is about 25.6 inches with the barometer at 30 inches, the compression being approximately as 11 : 76, or roughly, 1 : 7. The overall efficiency of this plant is, therefore, apparently still further reduced, because air is admitted from the atmosphere into the auxiliary condenser which is under a vacuum of 25.6 inches, and this, together with the air from the condenser, has also to be ejected by the secondary ejector to the atmosphere.

When Professor Leblanc set out to design his ejector he foresaw the possibility of using an intermediate condenser, but he also appreciated its disadvantages, and decided to do without it if at all possible. At the same time, he knew that it was essential to use two stages in order to get a stable and efficient ejector. With this end in view, certain steam nozzles were designed on the lines of the formulae of Professor Rateau, and the action of the steam issuing from these nozzles when under high vacuum was directly observed. The result is shown by Fig. 11. The steam issuing from the mouth of the nozzle expands and contracts alternately, ultimately assuming a section of constant area. It was found that a number of these nozzles grouped together gave far better results than a single nozzle of the same throat area as the group of nozzles.

Number and Size of Nozzles

The reason for this is to a large extent due to the fact that the alternate increasing and decreasing of the cross sectional area of the steam stream is minimized by the contact of one steam stream with the next, when groups of nozzles are employed; and this helps to considerably increase the surface available for the entrainment of the air and gases. This entrainment is carried on mainly by friction, and it will be seen that if an appreciable amount of gas has to be dealt with the frictional surface exposed to the gas has to be as large as possible. It is also inversely proportional to the density of the gas or fluid. The number and size of the nozzles depends entirely on the space available in the diffuser, and keeping within the limits of workshop practice.

The smallest number employed by the Mirrlees Watson Co. is three, each of which has a throat diameter of 1 mm. These are first-stage nozzles. On the largest size of pump, and in the second stage the number of nozzles is 30, and these have a throat diameter of 5.2 mm., when using operating steam at 90 lbs. per square inch. Professor Leblanc, in his paper of 1911 to L'Association Technique Maritime, says that "the operating steam entrains the air by friction. During entrainment it is the velocity of the steam which is utilized, and not its kinetic energy." Calling M the weight of operating steam used per second, V its velocity at the outlet of the nozzles, m the weight of air drawn in per second, and W the velocity of the mixture of air and steam, then—$MV = (M + m)\ W$.

The ratio of kinetic energy, $\frac{mW^2}{2}$ of the air drawn into the kinetic energy, $\frac{MV^2}{2}$, contained in the operating steam as it comes out of the nozzles, can, therefore, be stated as

$$\frac{m\,W^2}{M\,V^2} = \frac{m\,M}{(M + m)^2}$$

so that when $\frac{m}{M} = 1$, ½, 1-3, ¼, 1-5.

$$\frac{m\,M}{(M+m)^2} = .25,\ .222,\ .187,\ .160,\ .139.$$

This shows that if the utilization of the kinetic energy is to be the basis of the design, then for maximum efficiency it is necessary to bring the ratio $\frac{\text{Air dealt with}}{\text{Operating steam used}}$ as near to unity as possible.

M. Leblanc continues:—"We tried to diminish the loss of kinetic energy by producing at the entrance of the diffuser a higher vacuum than was necessary, so that the fluid drawn in came in contact

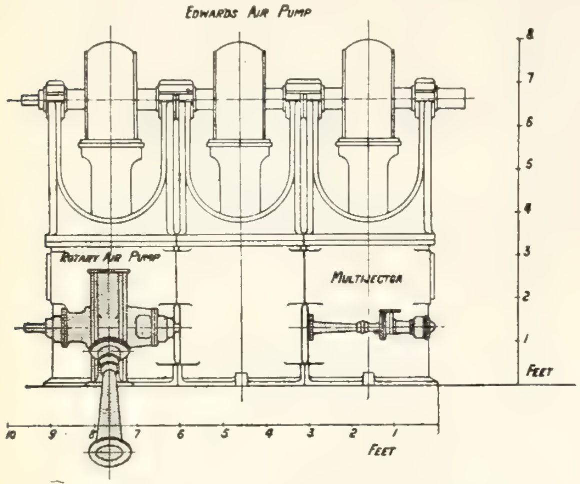


FIG. 12. RELATIVE SIZES OF "EDWARDS," ROTARY, AND MULTIJECTOR AIR PUMPS FOR SAME STEAM DUTY. WEIGHTS 20,832 LBS., 4,480 LBS., 97 LBS. RESPECTIVELY

with the operating steam with a considerable velocity. If the efficiency of the diffuser could be brought almost to unity, we could add considerably to the over-all efficiency, but this has been found to be impracticable. Following on this, it was suggested to use puffs of steam after the manner of steam coming out of locomotive chimneys, but the complications involved in making arrangements for stopping the inlet of air during each puff were such that it would have been easier to use a centrifugal compressor. Afterwards we tried to compensate for the bad efficiency due to frictional entrainment by transforming heat into kinetic energy in the nozzles. Superheating the operating steam, although so useful for turbine work, is, however, not good for an ejector, because it is more difficult to effect compression in the diffuser which outweighs the advantages obtained in the nozzles. The next scheme was to use hot water in the nozzles, but this likewise proved unsuccessful."

Entrainment by Friction

After numerous other trials, it was decided that entrainment by friction was most economical, and various types of diffusers and different groupings of nozzles were experimented with, until the present ejector, as shown in Figs. 8, 9 and 10, was decided to be the most suited for condenser work. To go through the various stages in detail which led up to this design would take up too much time. With the form of ejector adopted, it has been found that the efficiency of the nozzle is on an average 85 per cent., whilst that of the diffuser is 70 per cent. It will be seen that this ejector agrees very well with the ideal ejector which Prof. Leblanc had in his mind. The first stage, which consists of a small group of nozzles, serves a triple purpose, inasmuch as it effects a certain amount of compression heats up the entrained air, and gives it considerable velocity, and consequently an increase in momentum. The second stage has a larger number of nozzles, and it is here where the major portion of the work is done, the air being compressed from approximately 26 inches vacuum up to something more than atmospheric pressure. To be more accurate, the steam used in the first stage is about 5 per cent. of the total.

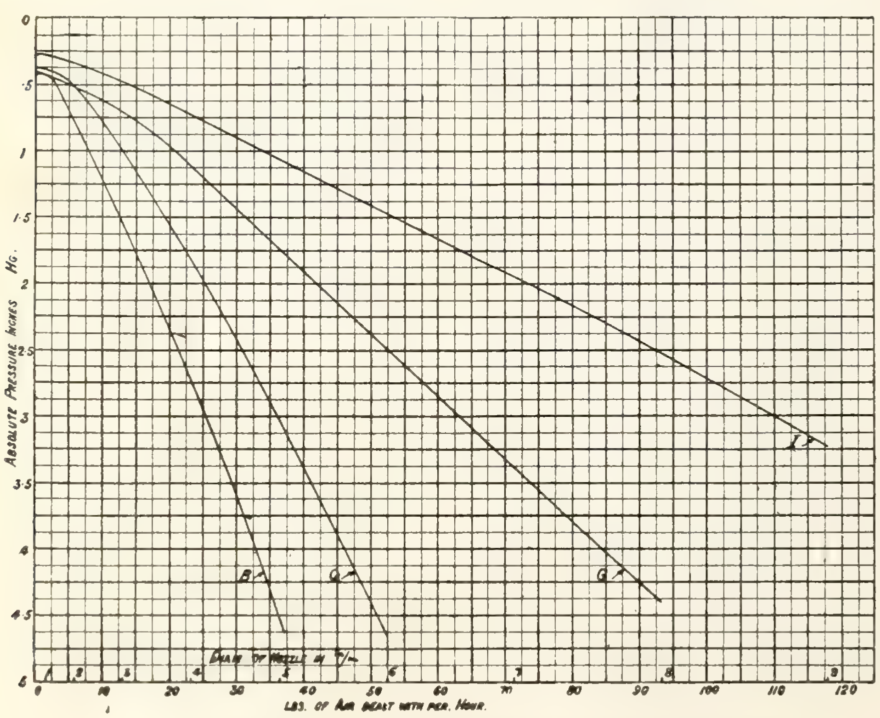


FIG. 13. AIR DEALING CAPACITY OF VARIOUS "MIRRLEES-LEBLANC" MULTIJECTORS.

High Vacuum Results

In support of the fourth advantage which this air-pump is supposed to possess, the following figures were obtained on the French torpedo-destroyer Boutefeu. The turbines were stopped, but steam was on the glands. The volume to be evacuated was about 635 cubic feet. After one minute, the vacuum was 6 5-16 inches, two minutes 15 inches, three minutes 22 13-16 inches, four minutes 25 9-16 inches, five minutes 26¾ inches, and six minutes 27 9-16 inches. The theoretical vacuum corresponding to the temperature of the water 67.1 deg. Fah., viz., 28¼ inches, was attained in 11 minutes. It was also arranged later to allow certain known air leakages to enter the condenser. With a 5 mm. nozzle which passes 36.2 lbs. of free air per hour, the vacuum dropped only ⅜ inch. With a 15 mm. nozzle, which is equivalent to 326 lbs. of air per hour, the vacuum was 21¼ inches. With an inch cock full open it took 11 minutes for the vacuum to fall to 12¼ inches, at which figure the mercury column remained steady. On closing the regulating valve below the nozzle,

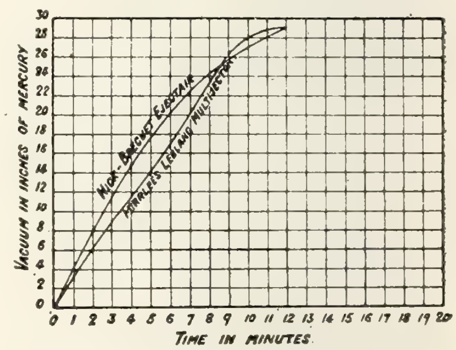


FIG. 14. DIAGRAM OF TIME TAKEN TO START UP A "HICK-BREGUET" EJECTAIR, AND A "MIRRLEES-LEBLANC" MULTIJECTOR.

the vacuum at once rose and attained the maximum almost immediately.

There is a central station near Glasgow where this type of apparatus is at work with a multi-jet condenser. Sometimes when changing machines they are liable to partially lose their water for a minute or so, but none of the staff ever have to trouble about the ejectors for, as soon as the water comes back again, the vacuum at once builds up, and the set is never shut down through failure of the air-pumps. As a matter of fact, in the case above stated, it is highly probable that during the period that the water supply to the condenser is very small, there is an air passage between the water spaces of the other condensers in the station and the multi-jet plant which would allow of a very excessive quantity of air getting into the condenser on load. This also shows that stability, the sixth claim, is another salient point.

That high vacuum can be obtained is proved by the fact that this apparatus is now being used in the French navy and mercantile marine, as well as on some land installations for refrigerating pur-

poses, and installations are at work where the maximum vacuum obtained is within 1 mm. of the barometer. For condenser work the best results obtained so far by the French Westinghouse Co. are within 5 mm. of the barometer. From the foregoing remarks it would appear that this type of air-pump is ideal for use on board ship, and particularly in the navy, where space is so valuable and weight of such consideration. To illustrate this point, Fig. 12 has been produced, and represents to the same scale an Edwards' air pump, Leblanc rotary air pump, and Leblanc multijector for a steam duty on a surface condenser of 40,000 lbs. per hour, with water at 60 degs. The vacuum 28½ inches, and barometer 30 inches. The weights are approximately 20,832 lbs., 4,480 lbs., and 97 lbs. respectively. For land work it is equally suitable, and will soon supersede the rotary pump in many power stations. For sugar refineries, chemical, and other allied works it should prove exceptionally attractive, and take the place of many reciprocating dry air-pumps, particularly as in such factories the exhaust steam can generally be utilized to the fullest advantage on other processes. It may be advisable to point out here that this pump is purely a dry air-pump, so that for surface condensers as additional water or condensate extraction pump is still required, and for jet plants, the usual extraction pump.

Fig. 13 shows the aid-dealing capacity of various sizes of multijector pumps taken from the actual tests. The maximum vacuum in each case is equivalent to the theoretical, the slight difference at the origin of the curves being due to the different conditions under which each pump was tested.

The Table of Tests is taken from a plant installed at the Scotish Central Power Station at Bonnybridge at a date six months after the plant was put on commercial load. This Company have just decided to order another plant, and have specified Mirrlees-Leblanc multijector air-pumps.

Fig. 14 shows the time taken to start up a Hick-Brequet ejector and that of a Mirrlees-Leblanc multijector.

No. 18 M. J. Condensing Plant with motor-driven Water-Extracting Pump, 1-Size "G" and 1-Size "I" Multijector Air-Pump installed at the Scottish Central Electric Power Co., Ltd., Bonnybridge.

Duty—50,000 lbs. steam per hour.
Vacuum—28·5″ (Bar. 30″).
Injection Water—3,800 Galls. per min., Temp. 65° Fah.
Air-Pump Capacity—84 lbs. air per hour with guaranteed vacuum and water temperature.
Large Ejector to operate condenser alone on loads over ⅓ and up to ⅔ full load.
Small Ejector to work alone on loads of ⅓ full load and under.
Both Ejectors to work on loads over ⅔ full load.

Time.	Load.				Vacuum.		Barometer	Steam Press. on Ejectors.		Steam Press on Turbine	Injection Water.		Extraction Pump.			
	Volts.	Amps.	P.F.	K W.	Turbo.	Condr.		"G."	"I."		Inlet	Outlet.	Press Gauge.	Amps.	Volts.	R P M.
8.45 P.M.	6350	130	·75	1070	28·1	28·2	29·8	120	Shut off	152	—	—	5	58/60	440	480
11.0 A.M.	6350	266	·7	2000	28·5	28·5	29·66	122	130	152	43	70	4	60	..	..
12 0 A.M.	6350	280	·7	2152	28·6	28·5	29·63	122	125	152	43	70	4½	59	..	..
12.5 A.M.	6400	270	·7	2090	—	28·2	29·63	Shut	125	152	43	70	4½	59	..	..
2.15 P.M.	6400	325	75	2700	28·2	28·25	29·59	125	160	150	43	72·5	5	62½	..	..
2 45 P.M.	6450	345	·76	2970	28·2	28·3	29·59	125	157	157	43	72·5	5	62½	..	..
3.0 P.M.	6500	280	·74	2330	28·2	28·4	29·6	122½	160	153	43	65·5	4	62½	..	..
3.30 P.M.	6500	230	·7	1812	28·5	28·5	29·6	120	150	154	43	65·5	2	53	..	..

OFFICIAL TEST DATA OF "MIRRLEES-LEBLANC" MULTIJECTOR AIR PUMP.

Figs. 15 and 16 show an application of Leblanc ejectors for refrigerating purposes. The arrangement is that supplied for magazine cooling on the French cruiser "Souffren."

There is no doubt that considerable improvements have been effected in air-pump design during the last few years, nevertheless there is still room for much further progress, and it is to be hoped that when hostilities cease and the British engineer has time once again for research work of this nature we shall have to drop all our present-day notions of efficient air-pumps for a type which will compel all others to become obsolete.

POWER PLANT OPERATION AND MANAGEMENT

TO obtain the greatest efficiency possible in a power plant is not only a matter of design, but a good deal a matter of proper operation and management. Most power plants could make large savings in this way, and there are exceptionally few where some improvements could not be made without spending a dollar for new equipment. To obtain full benefit from the equipment on hand, the men operating it must be made more efficient, and this can be done by education, strict supervision, pay according to merits (bonus system), competition and advancement, welfare.

Education, while the most important, is also the most neglected factor in economic operation of a power plant. This is especially true in the boiler room where the waste is greatest. Skilled labor should be employed. Ordinarily, anyone is hired who will work for low wages and maintain the steam pressure. Every boiler room should have a man with authority to give orders and with sufficient personality to have his orders respected. This man should predetermine by the proper use of various instruments, the most economical ways of burning coal and instruct the firemen as to the best methods, and then insist that these methods be carried out.

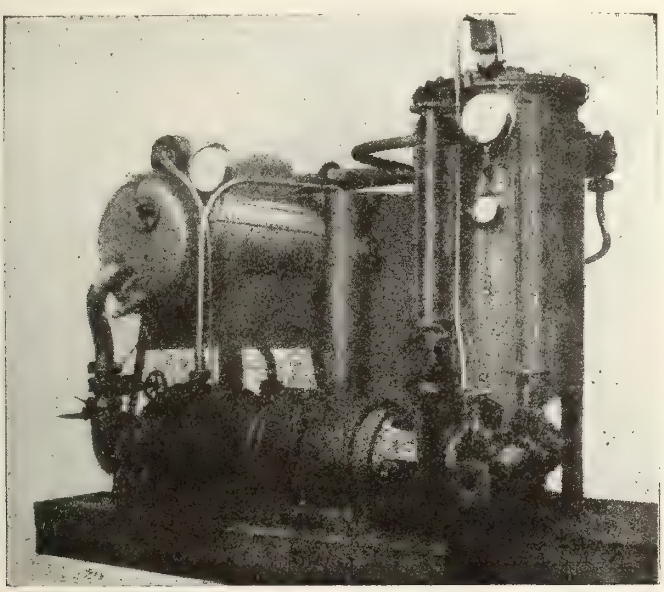


FIG. 15. APPLICATION OF "LEBLANC" EJECTORS FOR REFIGERATING PURPOSES.

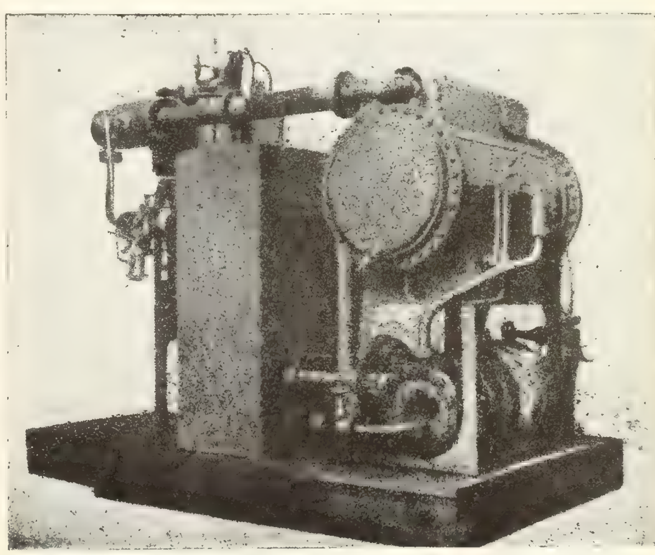


FIG. 16. APPLICATION OF "LEBLANC" EJECTORS FOR REFRIGERATNG PURPOSES.

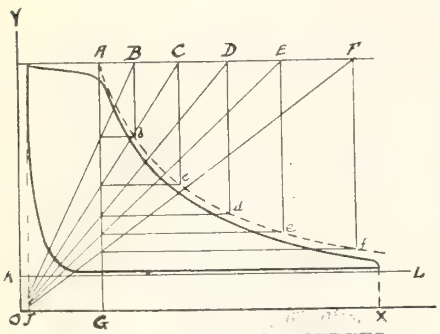
Accessory Equipment of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that determined effort is being put forth to initiate not only the design and construction of standard type ships for specific services, but that of their motive power—main and auxiliary reciprocating steam engine equipment, as well, with a view to acceleration of output and higher duty sea performance, this series of articles, describing and illustrating at least the more important instruments and accessory apparatus of the engine and boiler rooms seems to us more or less timely. The detail features of the various mechanisms will be discussed at length, also their specific application and utility scope.

CONCERNING INDICATOR DIAGRAMS—III.

THE expansion line on an indicator card from the point of cut-off to the point of release should be an adiabatic curve, that is a curve which represents neither gain nor loss of heat. As the curves on actual cards never follow this line, it is a good plan to draw an



DRAWING EXPANSION CURVES.

adiabatic curve on the indicator card for reference. To draw this curve accurately requires the use of a rather complicated formula, but as it very nearly corresponds to an hyperbola, the latter can be drawn by simple graphical means.

In the diagram shown, the dotted line represents the curve so drawn. The vacuum line OX is drawn at a distance to scale below the atmospheric line KL, corresponding to barometer pressure, practically 14.7 lbs.; OY is the clearance line, and YF is drawn parallel to OX through the point of highest steam pressure shown on the card. Continue the expansion line up until it meets this line at A. Select any number of points B, C, D, E, F; connect each of these to O, and draw the line AG parallel to OY. From the points where the radial lines cross the line AG, draw horizontal lines, and from the points B, C, D, E, F drop vertical lines. Through the points where these two sets of lines meet draw curve b.c.d.e.f., which is an exact hyperbola. The true adiabatic curve is slightly below the hyperbolic curve, but the latter is accurate enough for all practical purposes.

The saturation curve or the relation between pressures and volumes as given in steam tables is also sometimes drawn on an indicator card. Generally this curve will fall between the hyperbola as drawn above and the real expansion line of the indicator card. Instructions for drawing saturation curves by means of steam tables will be given later.

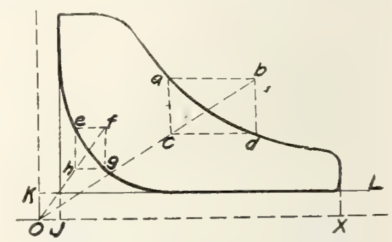
Cylinder Clearance

The clearance in an engine cylinder is usually determined by measuring the volume inside not swept through by the piston. In other words, the length of the inside of the cylinder minus the stroke of the piston times the area of the cylinder gives the clearance volume. The ratio of this volume to the volume of piston displacement is the clearance. However, it is often impossible to measure this clearance exactly, in which case it can be fairly accurately determined from the indicator diagram, the procedure being very nearly the reverse of that given above for drawing expansion curves.

Take a good indicator diagram and lay out the vacuum lines OX parallel to the atmospheric line KL. Take two points (ad) on the expansion line and (eg) on the compression line and draw horizontal and vertical lines through these points, completing the rectangles (abcd) and (efgh). Draw diagonals through these rectangles and the points where they cross the vacuum line at O determines the clearance. The ratio of clearance is OJ divided by JX. In using this method for determining the clearance a number of diagrams should, of course, be laid out as above and the average result taken.

Characteristic Diagrams

Single Valve Throttling Engine.—The diagrams Figs. 1 and 2 were taken with the same spring and illustrate very well the action of the governor. Fig. 1 shows a light load and Fig. 2 a heavy load. The point of cut-off always remains at the same point, about three-quarters stroke, but as the load increases, more steam is admitted to the cylinder, and the initial pressure is consequently higher.



DETERMINING CLEARANCE FROM DIAGRAM.

Single Valve Automatic Cut-off Engine.—Figs. 3 and 4 represent respectively light and heavy loads. The initial steam pressure is about the same, and as the load increases, the point of cut-off occurs later in the stroke. Compression becomes later as the cut-off increases. The points of admission and release change also, but not so noticeably as the cut-off and compression.

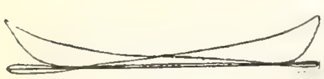


FIG. 1.

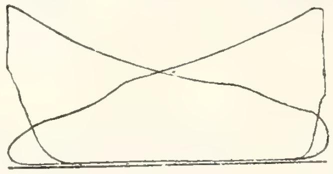


FIG. 2.

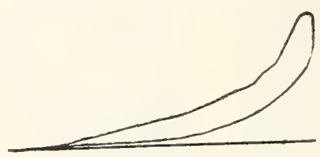


FIG. 3.

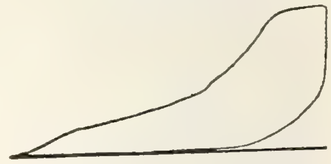


FIG. 4.

High Speed (250-300 r.p.m.) Single Valve Automatic Engine.—The first diagram, Fig. 5, shows the "friction load" or work done in overcoming friction in the engine itself. Diagrams for heavier loads, Fig. 6, generally show large compression at the speeds given while the point of cut-off is rarely sharp.

Moderate Speed Corliss Engine.—Fig. 7 represents a load lighter than the most

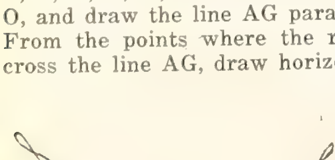


FIG. 5.

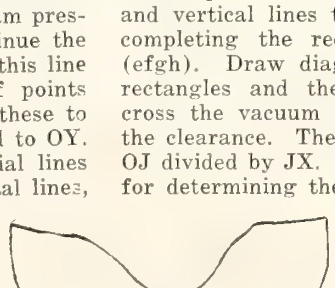


FIG. 6.

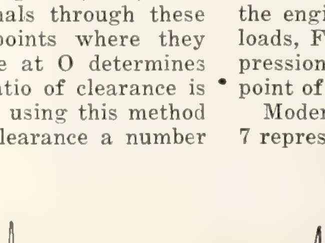


FIG. 7.

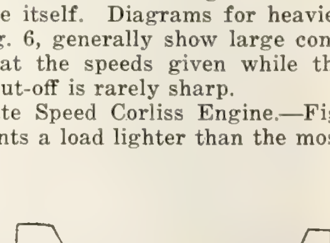


FIG. 8.

economical, and Fig. 8 about normal load. When the valves are in good order there is always a characteristically sharp cut-off, small compression is required because of slow speed and quick admission.

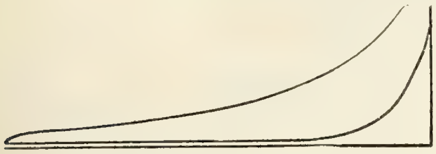


FIG. 9.

The exhaust line being below the atmospheric line demonstrates that the engine is running condensing. The amount of vacuum in pounds on the return stroke is the distance between the exhaust and atmospheric lines measured on a scale corresponding to the spring used in the indicator cylinder.

Four Poppet Valve Engine.—Fig. 9 is a characteristic diagram of the most recent type Nordberg poppet valve, non-condensing, 200 r.p.m., engine showing 31.75 m.e.p.

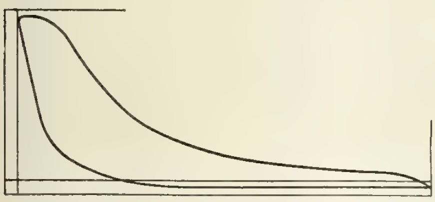
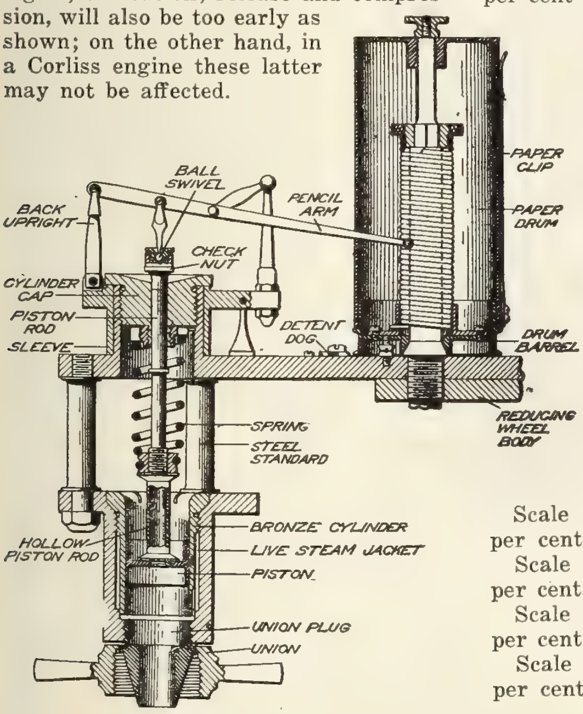


FIG. 10.

Uniflow Engine.—Fig. 10 is a characteristic card from a latest type Nordberg uniflow condensing engine, operating under normal conditions.

Faulty Diagrams

Too Early Admission.—The line hd, Fig. 11, slants backward instead of being almost perpendicular. In a single valve engine, the cut-off, release and compression, will also be too early as shown; on the other hand, in a Corliss engine these latter may not be affected.



In the single moved on the shaft to decrease its angle valve engine, the eccentric should be of advance, while in the Corliss engine, the lap of the admission valve should be increased. When release occurs too early as at b, there is loss of mean pressure. The valve should be set so that the drop from the expansion line to the back pressure line is as close as possible to the end of the stroke.

Admission Too Late.—The admission line cd, Figs. 12 and 13, slants forward instead of being nearly perpendicular. With Corliss or releasing gears, it results from valves becoming misplaced or being badly set. Admission may be secured earlier by reducing the admission valve laps. With single slide valve engines, other events of the engine stroke

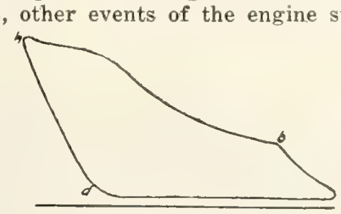


FIG. 11.

are also late, as shown in Fig. 13. Release occurs so late, that there is excessive back pressure at the beginning of the return stroke. The valve should be set so that the drop from expansion line to exhaust line is at the end of stroke.

BOILER SCALE AND FUEL LOSS

THE loss of fuel caused by scale in steam boilers may in a general way be averaged as follows:

Scale 1-64-in. thick causes a loss of 2 per cent. of fuel.

Scale 1-32-in. thick causes a loss of 4 per cent. of uel.

Scale 1-16-in. thick causes a loss of 9 per cent. of fuel.

Scale ⅛-in. thick causes a loss of 18 per cent. of fuel.

Scale 3-16 in. thick causes a loss of 27 per cent of fuel.

Scale ¼-in. thick causes a loss of 38 per cent .of fuel.

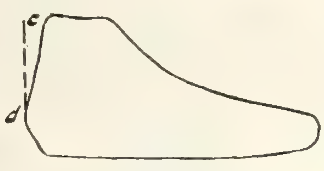


FIG. 12.

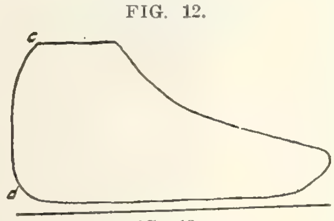


FIG. 13.

Scale ⅜-in. thick causes a loss of 48 per cent. of fuel.

Scale ½-in. thick causes a loss of 60 per cent. of fuel.

Scale ⅝-in. thick causes a loss of 74 per cent. of fuel.

Scale ¾-inch thick causes a loss of 90 per cent. of fuel.

SHIPPING AND THE SUBMARINE

ACCORDING to daily reports, which are necessarily more or less inaccurate, the total amount of shipping destroyed by submarines during the month of February was 202 ships, aggregating approximately 420,460 tons. The following table, which has been compiled by the New York Journal of Commerce, shows the submarine sinkings by months during the year 1916 and 1917 thus far:

Months 1916	Vessels No.	Tonnage Gr. Tons.
Jan.-Mar.	169	422,162
April	90	214,880
May	63	118,994
June	64	126,369
July	147	109,453
August	102	134,080
September	114	172,639
October	139	252,219
November	147	307,627
December	134	251,750
Jan., 1917	164	338,851
February	202	420,460

Taken by themselves, says The World's Markets, these records of destruction of merchant vessels are disquieting, but consideration must also be given to the amount of new construction that is going on. As against the grand total of 1,199 ships that were destroyed in 1916, aggregating 2,112,691 gross tons, 1,481 new ships were completed, with an aggregate tonnage of 1,961,276—making a net gain in the number of ships available for commerce or government transportation of 282, but a loss in displace ment of 157,564 gross tons.

The total merchant tonnage of the world in June, 1916, according to Lloyd's Register, was about 48,600,000, so that the net loss occasioned by submarines during the year amounted to one-half of one per cent. Of the new construction, the United States supplied 560,239 tons, according to the Bureau of Navigation, while the United Kingdom supplied 582,-305 tons, Japan 246,234, Netherlands 211,693, and other countries 360,805 tons altogether.

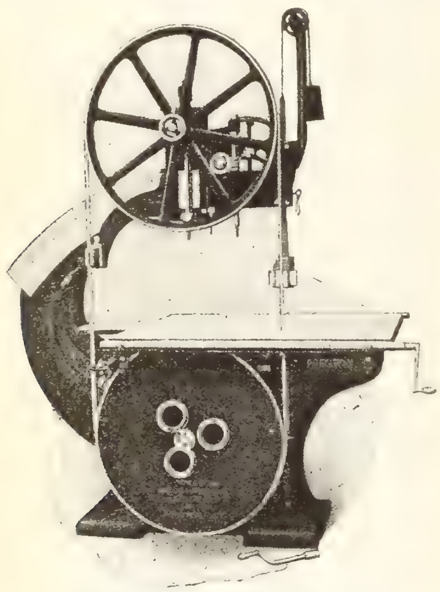
From reports regarding the activity of shipyards in all parts of the world it seems likely that, even though submarine warfare is continued on the same energetic scale as at present, the shipbuilders will surpass the ship destroyers by a considerable margin in 1917. Already the number of submarine sinkings reported appears to be decreasing measurably, and there is every probability that the monthly average will decline throughout the year. The output of the shipyards, on the other hand, is certain to increase. In the United States the number of steel ships under construction that are to be launched during the present year is 357, aggregating 1,250,722 tons. This total is exclusive of the wooden vessels that are being built. In Japan the number of vessels in course of construction is reported to be considerably larger this year than it was last and the same situation applies to most of the minor countries. No detailed statistics are available at the moment regarding the probable output of the United Kingdom for 1917, but in view of the greatly increased capacity of many shipyards, it is likely that the total amount of merchant tonnage launched during the year will exceed that for 1916 very materially.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

ADJUSTABLE BEVEL SHIP BAND SAW

THE band saw illustrated in the accompanying engravings is intended for all classes of band sawing where heavy stock has to be sawn bevelling. It is a recent product of the Preston Woodworking Machinery Co., Preston, Ont., and is specially adapted



BEVEL SHIP BAND SAW WITH DISC LOWER WHEEL.

to the use of ship and boat builders, navy yards, carshops, and all work where irregular sawing is done.

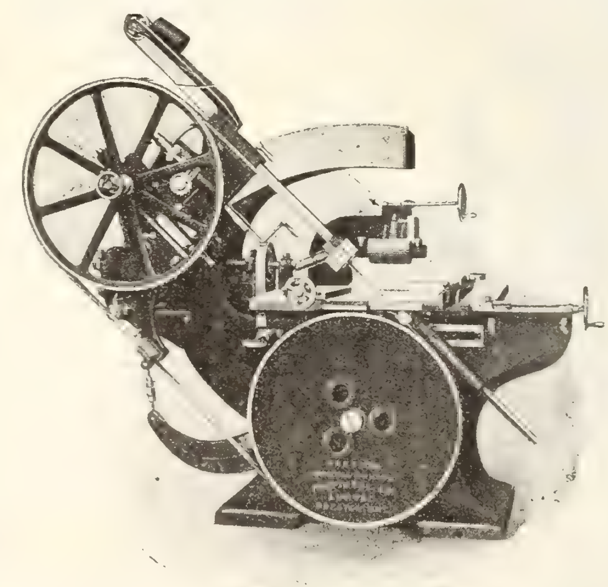
The frame is a one-piece casting, cored out in such a manner as to best distribute the material in order to eliminate vibration and ensure steadiness in running.

The wheels are 42 in. diameter and 2½ in. face. The bottom wheel is of solid web construction, the top being of arm pattern to make it as light as possible consistent with strength. They are very accurately balanced and covered with the best rubber covering. The top wheel frame can be adjusted to saw from square to any angle up to 45 deg. to the left, and can be adjusted to 10 degs. to the right from perpendicular. This latter is a very important feature. The wheel runs in long self-lubricating bronze bearings and is mounted in such a manner that it can be adjusted by hand wheel while in motion, for regulating the path of the saw to any position on the face of the wheel.

Adjustments can be made while the saw is in motion, by crank connection with worm and worm wheel on front, or by a large handwheel at the back of machine. Both back and front segments are graduated so that the operator can properly adjust the machine from either side. The bottom wheel shaft is very heavy and runs in long self-lubricating babbitt bearings or optional ball bearings, and is provided with a third bearing outside the tight and loose pulleys.

The table is of iron very heavily ribbed, and is 41 ins. x 43 ins. It is adjustable on main frame by hand-wheel as shown on cut. Adjustable iron plates are fitted into the table to close the opening when the saw is adjusted for different angles. The upper guide is fitted with hardened and ground steel roller back of the saw and with hard maple side guides. The guide bar is of steel 1½ ins. square and carefully counterbalanced. The lower guide with its attachment is automatically adjusted to the correct position to the saw blade at all times and at any angle.

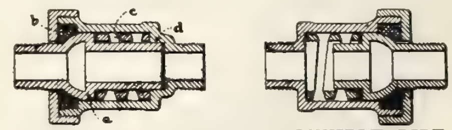
When using the power feed rolls this machine has a capacity up to 4 in. in thickness and 10 in. between the saw blade and the feed works stand. The capacity of the ripping gauge is from ¼ in. to 15 in. in width. A large saving is accomplished when using this machine for preparing cants used in the manufacture of columns, piping or any other class of work that requires building up, as there is practically no waste except the saw kirf. The net weight of this machine is 4,500 lbs. and floor space occupied is 4 ft. 3 in. x 7 ft. 10 in. It is supplied complete with belt shifter, brush for lower wheel, brazing clamp tongs and wrenches and one 2½ in. blade.



BEVEL SHIP BAND SAW ARRANGED FOR ANGULAR CUTTING.

ALL-METAL SWING AND FLEXIBLE PIPE JOINT

SWING and semi-pipe joints, which dispense with the use of packing and are suitable for steam, water, gas and oil, are made by the Rostern Co., People's Gas Building, Chicago. The joints, for which patents are pending, are made entirely of metal, the special feature being a ball-shaped shoulder revolving on a ring of anti-friction metal. Both types of joints are illustrated, one being designed for straight runs, while the other is intended for connections that are not tapped true.



ALL-METAL SWING AND FLEXIBLE PIPE JOINT.

The standard form of joint consists of a hollow cylinder having a ball-shaped shoulder (a) revolving on an anti-friction metal bearing ring (b). A cast metal spring (c), together with the pressure of the steam or other liquid passing through the joint, is relied upon to hold these two surfaces in close contact, the cylinder being kept in alignment by revolving in a socket (d). All of the parts of the joint are enclosed by the cap and the body. In the case of the oscillating joint, which can be adjusted for various differences of alignment up to 6 degs., the hollow cylinder that carries the ball-shaped shoulder is shortened. If a greater oscillation than 6 degs. is required, a special type of joint is supplied.

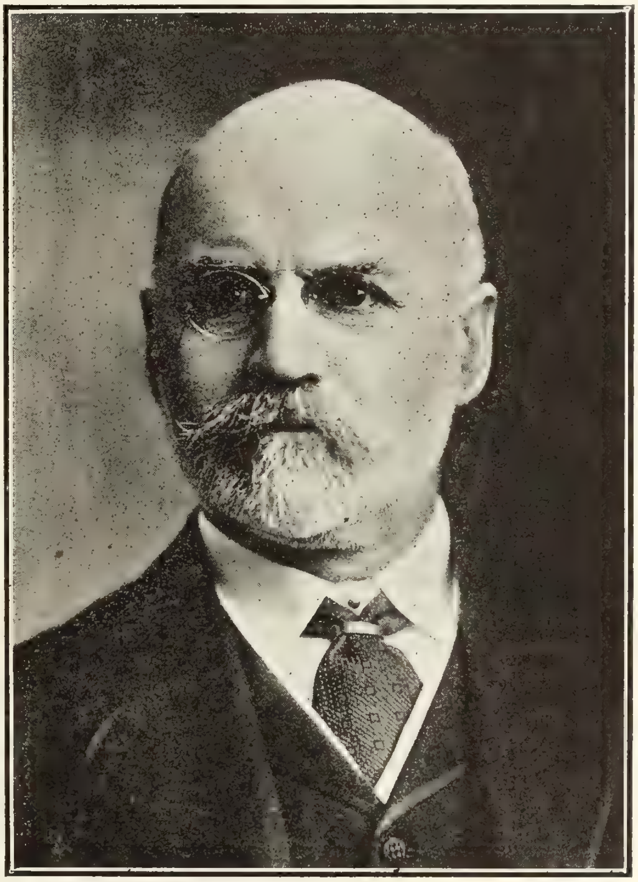
The joints have been found adaptable for connections between the platens of steam vulcanizing and wood bending presses, on laundry, paper and pulp machinery, for flexible pipe lines in mines and quarries, for steam blowers in locomotive roundhouses, for water doors or open-hearth furnaces, etc. In connecting two steam platens it is suggested by the manufacturers that the semi-flexible joints be used on press platens to overcome irregularities in closing, and to care for holes that are tapped out of line. A series of the joints in connection with ordinary pipes and elbows will give a maximum of flexibility.

The Rostern Co. reports tests in which the joints were used with steam at 350 degs. Fah. alternating with water at 64 degs. Fah., the changes being made rapidly and with no unfavorable results. The joints are of bronze in sizes ranging from ⅜ to 2 in., with larger sizes in steel, iron and special metals, and also with elbow ends.

Reading makes a full man; writing an exact man; conference a ready man.

CANADIAN MARINE "HEADLIGHTS"

WILLIAM I. GEAR, Colonel, Justice of the Peace, merchant, steamship owner and agent, Montreal; director of steel shipbuilding, Imperial Munitions Board, Ottawa; vice-pres., the Robt. Reford Co., steamship agents, 20 Hospital Street, Montreal; president, Crown Trust Co.; president, Canada Nitro-Products, Ltd.; director, Bank of Toronto; director, Keewatin Flour Mills Co., director, Cairn Line of Steamships, Ltd., and connected with



WILLIAM I. GEAR

various other enterprises, was born in Toronto, Ont., May 20, 1857, son of Henry J. and Jane (Martin) Gear. He is Lt.-Col. O. C. 1st Regiment (Canadian Grenadier Guards); was president, Corn Exchange, Montreal, 1902; president, Montreal Board of Trade, 1905; member of Committee, Chambre de Commerce, Montreal, 1913 and 1916, and represented transportation interests on the St. Lawrence River Commission, 1911-1912. He served as Alderman, Longueuil, Que., from 1908-1912.

Col. Gear's clubs are St. James'; Canada; Canadian; M.A.A.A., etc., of Montreal; Rideau (Ottawa); Union (St. John); Halifax (Halifax); British Empire and Royal Colonial Institute, etc., (London, Eng.). His residence is 450 Mackay St., Montreal; the summer he, however, usually spends at Longueuil, Que.

Photo courtesy British and Colonial Press.

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PRINCIPAL CONTENTS

MERCHANT SHIPBUILDING PUBLICITY

AT the beginning of the present month, the United States authorities at Washington gave official intimation that the lid would be shut down tight on information to the public so far as the development and progress of the national shipbuilding programme was concerned. Apparently, the circumstances necessitating such a drastic measure left no alternative—the activities of German sympathizers being directed against new plant establishment at various centres and with, unfortunately, some considerable degree of success. War vessel construction and movements, and the latter even so far as merchant craft are concerned, are on common-sense as well as strategical grounds closely veiled from the public, but whether due to instinct or education, the lack of this data neither arouses curiosity nor causes irritation. In peace times, little of real naval construction achievement gets beyond a very charmed circle in any country, and even when a type ship and its equipment passes into the fleet reserve and, later, into the discard, the detail does not become publicly available. This, of course, is as it should be, for the possibilities are many that in some feature or features even a discard might provide the stepping stones of advantage to an unfriendly or unscrupulous competitor.

To merchant ship construction the public maintain an altogether different attitude, and while instinct may be wholly absent, it can truthfully be stated that education is largely responsible for the stand taken. In no previous war has merchant shipping figured so prominently, whether the latter be relative to what they have accomplished and continue to accomplish, or to the enormous tonnage losses sustained. Their vocation is rightfully looked upon as a peaceful one, in consequence their construction comes under the same category. On this account, instead of a spirit of curiosity being aroused when secrecy is enjoined and enforced, there is liable to supervene a considerable degree of irritation.

It would appear that Hun "submarines" are operative on land as well as at sea if we judge the situation rightly in the United States, and we might as well admit straightaway, that our views as to combatting them do not lie along the lines of secrecy. Meeting the submarine emergency, as the latter is popularly known, whether it be on sea or land, will be most promptly and effectively accomplished by dealing with the devils directly, instead of dodging them as appears to be the meantime tendency both ashore and afloat. We talk of sea power and as individual nations we claim to have land power, to the extent at least of the territory and the people embraced; but have we? Germany is endeavoring to show us that she owns both the land and sea power of the world meantime. Further, she is making a fairly effective display of her ownership. Isn't it just about time we told her and showed her otherwise? Publicity is the most potent known adversary of evildoing as it is of everything else that cannot measure up to the very moderate standards of human decency, then why not lengthen and strengthen its arm instead of paralyzing it?

Let us show Germany, that not only in the United States but here in Canada, we are openly planning and procuring accomplishment of the means whereby her devilishness is going to be absolutely squelched, and let us make the demonstration so comprehensive, and so public, that she will realize that her game of world-conquest is up, and that the oceans and their highways are free to all, irrespective of nationality, creed or color. In our haste to establish shipyards, munition factories, infantry and aviation camps, let us not forget internment camps for the Hun "submarines" at large in our cities and towns, if our jails are already or are likely to become too full. Both Canada and the United States have thousands of acres lying idle on which to erect domiciles for their enemies, besides the adjacent land might be none the worse for tilling.

Many things call for censorship in times like these, and while it may appear to be politic to have the ban operate as comprehensively as can be determined, a big advertising campaign concerning our merchant shipbuilding effort would undoubtedly shake German confidence to its foundations more quickly than will "sealing the lid" tight.

MARINE NEWS FROM EVERY SOURCE

Quebec, Que.—Quinlan & Robertson have a contract for the construction of four steamers.

Vancouver, B.C.—The wooden vessels which the Western Canada Shipyards, Ltd., will build will be 2,800 gross tons, 280 feet long and 44 feet beam.

The New Westminster Construction & Tug Co. has been incorporated at Victoria, B.C., with a capital of $30,000. Head office is at New Westminster, B.C.

Quebec, Que.—To encourage shipbuilding the civic authorities probably will open various docks near Quebec, in addition to those that have been working for the last few years on the south shore.

Goderich, Ont. — The National Shipbuilding Co. is arranging for the use of the Paget factory and Mr. Paget, of Huntsville, was in town recently in connection with the arrangements.

To Remove Plankinton Wreck.—The work of salvaging the cargo and machinery of the steamer John Plankinton, which sank in the Canadian channel of the Detroit River several weeks ago in collision with a Grand Trunk car ferry has begun.

Port Arthur, Ont.—The Canadian General Electric Company have secured the contract for the sub-station and electrical equipment for the plant of the Eastern Terminal Elevator, now being built at Current River, Port Arthur, for Jas. Richardson & Sons.

Vancouver, B.C.—The Foundation Co. has been awarded contracts to build five wooden steamships for the British Government through the Imperial Munitions Board. The ground has been broken on the Songhees Reserve site, and work will be rushed to get the plant ready.

Victoria, B.C.—Rapid progress continues on the old Songhees Reserve, where the Foundation Co. and the Cameron-Genoa Mills Shipbuilders are busily engaged in making preparations for laying down keels for the wooden steamers to be built in Victoria to the order of the Imperial Munitions Board.

Port Arthur, Ont.—Earnings of the Port Arthur Shipbuilding Co. are reported as running at an extremely satisfactory rate, with raw material arriving ahead of requirements. Contracts now on the books of the company for delivery prior to the close of navigation, 1918, total approximately $6,000,000.

P. & O. Amalgamate With Union S.S. Co.—The Peninsular & Oriental Steam Navigation Co. has amalgamated with the Union Steamship Co. of New Zealand, opening the Canadian-Australian line from Vancouver to Honolulu and Sydney, it was announced at Vancouver recently.

Fort William, Ont.—The work of excavation has been started at the plant of the Great Lakes Dredging Co., on island number two, for the ways for the keel blocks of the first wooden ship to be built in Fort William. As soon as it is possible to get this done, the work of construction on the first of the wooden ships will be started.

New Westminster, B.C.—Preliminary to building four of the wooden steamers ordered by the Imperial Munitions Board, the New Westminster Construction & Engineering Co. is clearing the site for its shipyard on Poplar Island. The vessels will be 250 feet long by 44 feet beam, and will have a capacity of over a million and a half feet of lumber.

New Westminster, B.C.—A request for exemption from taxation for eight or ten years in consideration of the establishment of a wooden shipbuilding plant at Queensborough was laid before the City Council in committee recently by Messrs. Van Syckle and Macdonald, of Vancouver. The cost of the plant they propose to establish will be from $50,000 to $100,000.

Shortage of Sextants.—Numerous new vessels building in the United States have depleted the stock of chronometers and sextants and with Germany not furnishing them as before, and England requiring those manufactured for British ships, it has been asked that endeavors be made to have the Navy Department assist in relinquishing extra chronometers carried on vessels.

Fort William, Ont.—Crib work and foundation work on the new Eastern Terminal Elevator Co. new plant at Current river, Port Arthur, is now well under way, according to Superintendent R. D. Morgan. It is hoped that the elevator will be ready for operation by January 1st of next year. The tank foundations of the Saskatchewan Co-operative Elevator Co.'s buildings are being constructed.

Charlottetown, P.E.I.—It is expected that by next August the car ferry "Prince Edward Island" will start running between Point Borden, Prince Edward Island, and Cape Tormentine, N. B., the route for which she was built. The steamer has been running between Charlottetown and Pictou and Georgetown and Pictou for the past two years, as the docks between Tormentine and Borden were not ready.

St. John, N.B.—Grant & Horne have been given a contract by the Imperial Munitions Board to build two wooden ships at their new yard in Erin street. They are to be 250 feet long with 43½ feet beam, and will have 25 feet depth of hold. The speed will be 9½ knots and the boats will have a cargo capacity of practically 3,000 tons. The engines will be supplied by the Board.

Rammed and Sunk.—The Cleveland steamer William S. Mack was rammed and sunk off Whitefish Point on July 9, during a heavy fog by the Manitoba of the C.P.R. Lakes fleet. The Manitoba struck the Mack a glancing blow, sustaining, however, only a slight bruise on her starboard bow and losing an anchor. The Mack headed for shore following the collision, grounding in twenty feet of water near the lighthouse.

Victoria, B.C.—The shipbuilding plant operated by the Cameron Genoa Mills Shipbuilders, Ltd., where the auxiliary schooners are now in various stages of construction, is to be enlarged for the purpose of making an immediate start on the four wooden steamers which have been awarded the concern by the Imperial Munitions Board. A new building ways is being laid down on the ground now under lease to the company.

Port Arthur, Ont.—On June 23, the Port Arthur Shipbuilding Co. launched the steamer, Ugelstad, which has been built for the Great Lakes Transportatios Co. It is understood the company has already disposed of it to Norwegian capitalists. Miss Eva Powley of Port Arthur christened the boat in the orthodox way. The boat is a freighter of canal size, 261 feet long, 43½ feet beam with a depth of 28 feet. Her carrying capacity is 4,200 tons.

Victoria, B.C.—The sixth and last keel, covered by the contracts at present held by the Cameron Genoa Mills Shipbuilders, for auxiliary schooners, was laid down on June 23 on the ways vacated by the schooner Esquimalt, which was launched on the night of June 13. On the completion of these vessels, the company will thereafter have its hands full in rushing to completion the four wooden steamers for which it holds contracts from the Imperial Munitions Board.

Owen Sound, Ont.—Word was brought here during the month of total destruction by fire of the fisheries patrol motor boat "Wawanna," which took place at Fitzwilliam Island, in the channel between Georgian Bay and Lake Huron. The "Wawanna" was formerly a pleasure cruising vessel, built for Henry Manley, of Meaford. Her steam power was re-

moved last summer, a powerful gasoline motor installed and other improvements were made, and the vessel went to Lake Erie to go on patrol service.

Esquimalt, B.C.—The contract for repairing the C.P.R. steamer Princess Maquinna which struck an uncharted reef of Kyuquot Sound, has been awarded to Yarrows, Ltd. The vessel has been hauled out on the ways at the local plant, and a survey been made. It is expected that three weeks will elapse before the Maquinna is ready for service again as there are eleven plates to be removed, five to be taken off and faired and six to be faired in place, in addition to other work, the damage being quite extensive.

Shawinigan Falls, Que.—The Canadian Aloxite Co., which will go extensively into the manufacture of carborundum and other abrasives, has started construction of a large plant at Shawinigan Falls. It will be completed some time towards the end of the year. The Shawinigan Water & Power Co., have contracted to supply 20,000 h.p. to the Canadian Aloxite Co., which is a subsidiary of the big Carborundum Co., of Niagara Falls. N.Y.

U. S. Will Build 400 Steel Ships.—An agreement has been reached regarding the proposed shipbuilding programme. The plan as outlined in a communication by General Goethals to Chairman Denman, calls for the immediate construction of two Government shipbuilding plants to produce 400 fabricated steel ships of 2.500.000 tonnage; the commandeering of 1,500,000 tons of shipping now under construction for private account in American yards, and for another big appropriation for building ships.

Contracts Let for Ship Machinery.—Contracts have been let so far for a total of one hundred and twenty winches and capstans to be built by British Columbia concerns for installation on the wooden steamers ordered by the Imperial Munitions Board. There will be twenty-seven of these vessels built in the province, and the first keeys have already been laid. Nine of the vessels will be built in Victoria, the contracts for same being divided between the Cameron-Genoa Shipbuilders, Ltd., and the Foundation Co.

Toronto, Ont.—Work will be commenced shortly on the construction of two modern vessels, canal size, for the Imperial Munitions Board. The vessels will be built on the new industrial area at Ashbridge's Bay. The contracts for the vessels were awarded to Messrs. John E. Russell, of the Russell Contracting Co., and John J. Manley, manager of the C. S. Boone Co. The steamers will be constructed of British Columbia Fir. Modern engines will be installed in addition to all modern machinery for hoisting and handling bulk freight.

Dominion Bridge May Build Ships.—Dominion Bridge officials are reticent as to future plans of the company in regard to the shipbuilding business, but there is a rumor that the company is about to enter that field. General Manager Duggan has made several visits to Halifax and Sydney of late, where he has conferred with the Beardmore and English interests. It is reported from the East that tentative arrangements have been made with one of the big steel companies for the erection of mills for the rolling of steel plates.

Quebec Bridge Progress.—It is understood that the new Quebec bridge will be ready for placing in position some time in September. Fabrication has been almost completed at the works of the St. Lawrence Bridge Co. and the erection of the span will be immediately proceeded with at the old location at Sillery Cove. It is fully expected that the process of raising the span from the scows to the arms of the cantilevers will be along similar lines as that adopted last year, but additional precautions will be made for the safety of the workmen.

Toronto, Ont.—The Polson Iron Works, Ltd., have had plans prepared for a new boiler shop, 250 ft. by 90 ft. wide. It will be of steel and concrete construction. The equipment will be the latest type, and will include an overhead electric travelling crane. The present boiler shop will be overhauled and re-fitted for an extension to the machine shop and engineering department. A new gantry crane, 65 ft. wide by 50 ft. high, of 10 tons capacity, is being erected on the east side of the dock. Other extensions include a lumber storage and auxiliary store house.

St. John, N.B.—B. A. Saker, of Montreal, before the Common Council, made his proposal for the establishment of a shipyard on the Warner Mill on the river front. He has secured the mill property with a thousand feet frontage on the river, and the lease of the adjoining property. He said that it was his intention to spend at least $100,000 during the first year in establishing yards capable of turning out three wooden vessels at the same time. When materials are available again, he intends to undertake the construction of 3,000-ton tramp steamers, which would require an additional investment of $200,000.

Increase in Loading Draft.—Increases in loading draft averaging from two to four inches are reported by the Lake Carriers' Association. The upbound draft for Lake St. Clair remains the same, while the downbound draft is increased two inches. There is an increase of four inches in downbound draft in the American and Canadian locks, and an increase in upbound draft at the American lock of one inch. The upbound draft recommended in the American lock is 20 feet 3 in. and in Lake St. Clair 20 feet 4 in. Downbound boats can load not to exceed 20 feet 6 in. for either the American or the Canadian lock.

Canadian Boats in Coastal Trade.—The United States coastwise laws have not been suspended, but arrangements have been made whereby Canadian vessels can trade between American ports. This is a war measure, and the plan, which will increase vessel capacity on this side, will probably be in operation the balance of the season. It is figured there are about twelve or fifteen Canadian vessels that can be placed in American coastwise trade for part of the season, but boats of that class have some contracts, and they will, of course, carry grain as soon as the fall movement starts at the Canadian head of the lakes.

Vancouver, B.C.—Within the next three months it is expected that the first keel of the six new vessels that are to be built in Vancouver for the Imperial Munitions Board will be laid by the new concern known as the Western Canada Shipyards, Ltd. The amalgamation of three well-known companies has resulted in the formation of this concern, these companies being Grant, Smith & McDonnell, the Northern Construction Co., and Armstrong & Morrison. Operations have already commenced for the laying out of the site of the shipyard, on the location of the old Royal City Mills on the north side of False Creek, a lengthy lease having been obtained by the board on behalf of the company. Thus the initial measures have been taken that may mean the establishment on a permanent basis of one of the largest shipbuilding plants in the Dominion. A. R. Mann, of the Northern Construction Co., is president and managing director of the concern.

C. G. S. "ARGENTEUIL"

C. A. LEBEL, acting agent of the Department of Marine and Fisheries, announces that a new boat, the C. G. S. Argenteuil, has been added to the fleet of the Montreal Agency. She has been built at the Government shipyard, Sorel, Que., for buoy and lighthouse work on Lake St. Louis, the Ottawa and Rideau Rivers, which district is under the control of the agent of the Department in Montreal. She was built under the supervision of W. S. Jackson, superintendent of the Government shipyard at Sorel, assisted by Robert McNab, in charge of the machinery, and Fred. Bridges, for the hull construction. As to the laying out of the vessel as a buoy and lighthouse steamer, Captain J. Davison Weir, superintendent of construction and lights for the Montreal district of the Marine Department, was consulted.

On her trial run the Argenteuil proved a success, both as to speed and buoy handling capacity. She is built of steel throughout with bottom and bilge plating protected by British Columbia fir sheathing for work in shallow and rock waters. There are three watertight bulkheads and a fore peak for trimming purposes.

The machinery consists of single screw jet condensing engines, having cylinders 10 in. and 20 in. in diameter by 16 in. stroke, supplied with steam from a Scotch boiler, 9 ft. 6 in. dia., by 10 ft. long, at a working pressure of 130 lbs. per sq. in. Steam stearing gear, steam windlass, electric lighting equipment, also a steam winch, with mast and derrick, capable of handling buoys up to 4-ton in weight, are installed. Her length over-all is 101 ft., 5 in.; breadth, 21 ft.; speed, 10 miles.

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

H. R. Storey, purser of the steamer Hamonic of the Northern Navigation Co., has resigned and accepted the management of a line of steamers on Georgian Bay.

E. H. Beazley, manager of the Union Steamship Co., of British Columbia, has left Vancouver, B.C., for England. He goes over to look into the shipping situation, and will be away for several months.

R. R. Gray Chisholm and T. H. Russell, representatives of the British Ministry of Shipping and the Imperial Munitions Board respectively, have arrived at Victoria, B.C., to confer with Mr. Butchart and Capt. J. W. Troup, local representatives of the Munitions Board.

Sub-Lieut. Robert Leckie, D.S.O., formerly of Toronto, has been awarded the Distinguished Service Cross for attacking and destroying Zeppelin L-22 off the East coast of England on May 14th. Lieut. Leckie is a native of Scotland, and was born in Glasgow 24 years ago. He is a nephew of John Leckie, and had been in Toronto for ten years previous to his training here for attachment with the Naval Aerial Service, and was connected with the firm of John Leckie & Co., marine supplies, Toronto.

E. F. Ashley Cooper, well known in Victoria, B.C., shipping circles, and for many years connected with the various steamers plying in the British Columbia coastal service, having served as purser aboard vessels of the C. P. R. and G. T. R. fleets, is now a lieutenant in the Royal Naval Volunteer Reserve. Mr. Cooper left Victoria last September to join the R.N.V.R. as a sub-lieutenant and the news of his promotion was received in the city recently. He is at present serving on H.M.S. Research.

T. S. Dickson, of William Beardmore & Co., shipbuilders, Glasgow, is in this country for the purpose of selecting a site for an extensive steel shipbuilding and dry dock plant. It has been definitely settled that a plant will be built in Canada. In company with A. D. Swan, consulting engineer, Montreal, Mr. Dickson has inspected sites at Montreal, Que.; Halifax, N.S., and St. John, N.B.

R. S. White, who a few months ago resigned his post as Collector of Customs of the Port of Montreal, after twenty-one years' services, was presented with $21,000 and an illuminated address by importers, manufacturers, merchants, and representatives of railway and steamship companies in Montreal, in appreciation and acknowledgment of his administration of the Customs service and courtesies during his tenure of office.

LICENSED PILOTS

ST. LAWRENCE RIVER.

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL.

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

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Secretary—Jas. Morrison, Montreal.

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President—O. H. Taylor New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

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SHIPMASTERS' ASSOCIATION OF CANADA

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

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J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I. Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

Captain David Sylvester, one of the best known men on the Great Lakes, having sailed our inland seas for many years, died on July 18 at Toronto, in his 80th year. In 1848 Captain Sylvester shipped with the Clarissa, owned and sailed by his uncle, Captain Jas. Taylor. The Clarissa sailed from the mouth of the Humber to Oswego, N.Y., with a cargo of flour. From that time on, Capt. Sylvester lived a seafaring life. At the age of 21 he owned and commanded his own vessels, the first being the schooner Atlantic. Capt. Sylvester gave up sailing eventually and went into the commission and brokerage business, leasing the Church Street wharf and elevator, where he, his cousin, and brother carried on a vessel-owning, wharfinger and grain storage trade, from which deceased retired only a few years ago. He was born in Scarboro Township.

W. G. Ross, chairman of the Montreal Harbor Commission, has returned to that city, following a successful organizing campaign in the Maritime Provinces on behalf of the Navy League of which he is Dominion president. Many branches of the League were formed, and in Newfoundland he inspected some of the naval recruits, many from which country are already on trawlers and drifters on the other side. At Halifax he addressed a meeting presided over by Hector McInnes, K.C., and at which there were also present Lieut.-Governor Grant, Premier Murray, as well as many of the leading citizens of the port who promised their cordial support to the movement. Mr. Ross, who was previously Director of Naval Recruiting in Canada, visited the Halifax dockyard and the ship Niobe, and was greatly impressed with the training which recruits got there before being sent over to the other side. He

1917 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand,	93 Fifth Avenue, Lachine, P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	[illegible] London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	176 King Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

also visited the large pier built by Sir John Kennedy, consulting engineer to the Montreal Harbor Commissioners, the upper story of which is now used for the accommodation of returned soldiers. Meetings were held at St. John, and at other points, and, while at Halifax, arrangements were made for the formation of a branch of the League in Prince Edward Island, so that the three Maritime Provinces are now fully organized.

Under C.P.R. Control.—A despatch from London states that the Canadian Pacific Ocean Services announce they have taken over the management and control of the Allan Line steamers and offices in the United Kingdom.

Montreal, Que.—The C.P.R. announces that an embargo has been placed upon all freight of any character, billed to Montreal wharf for export, with the exception of freight, consigned to, or in care of, the Director of Overseas Transport, and shipments on account of the Hudson Bay Co. Shipments of plywood, shooks, timber and lumber are also excepted.

Marine Insurance Rates Easier.—Advices from New York state that there is a decided softening in marine war risk insurance. Changes are principally in the import rates. From United Kingdom, they are down to 5 per cent. on armed ships and 6 per cent. on unarmed ships. France, 7 per cent. on armed ships, 8 per cent. on unarmed ships. Mediterranean, 7½ per cent. on armed ships, 8½ per cent on unarmed ships. Export rates, owing to the heavy volume of business being offered, do not show corresponding reductions, although there is a general easing. The export rates are, United Kingdom, 7 per cent. on armed ships and 9½ per cent. on unarmed belligerents and 10½ per cent. on neutrals, France 9 per cent. on armed ships and 11 per cent. on unarmed ships. Mediterranean, 10 per cent. on armed ships and 12 per cent. on unarmed ships.

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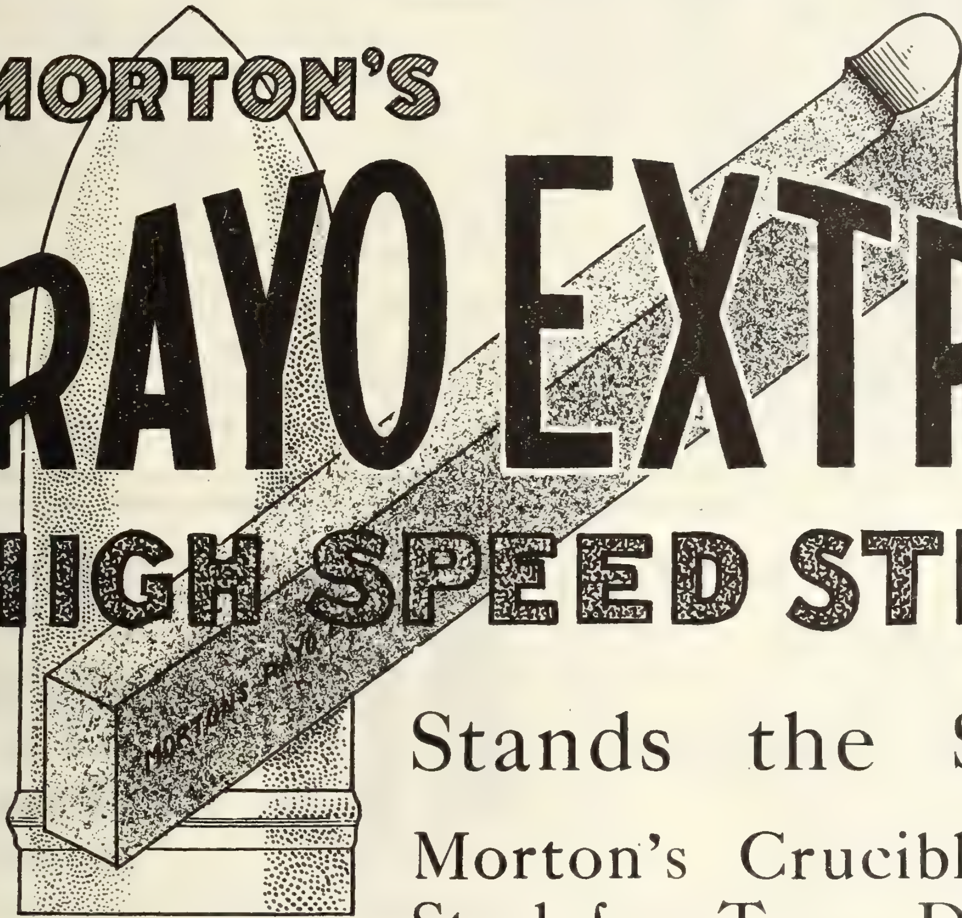

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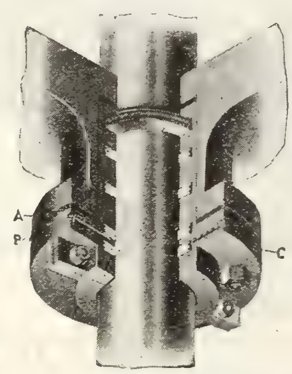
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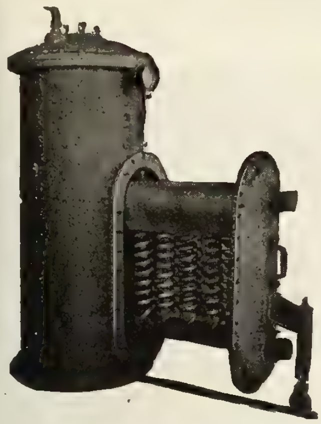
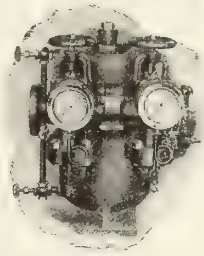
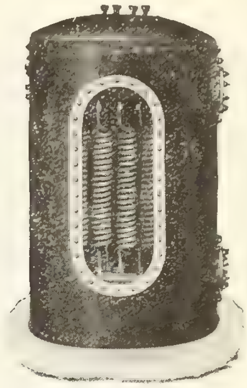


Reilly Marine Evaporator, Submerged Type



Reilly Multi-screen Feed Water Filter



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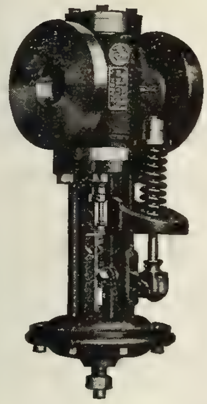

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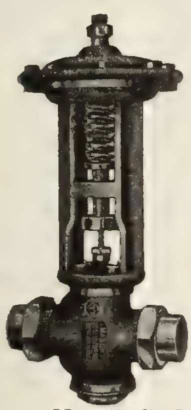

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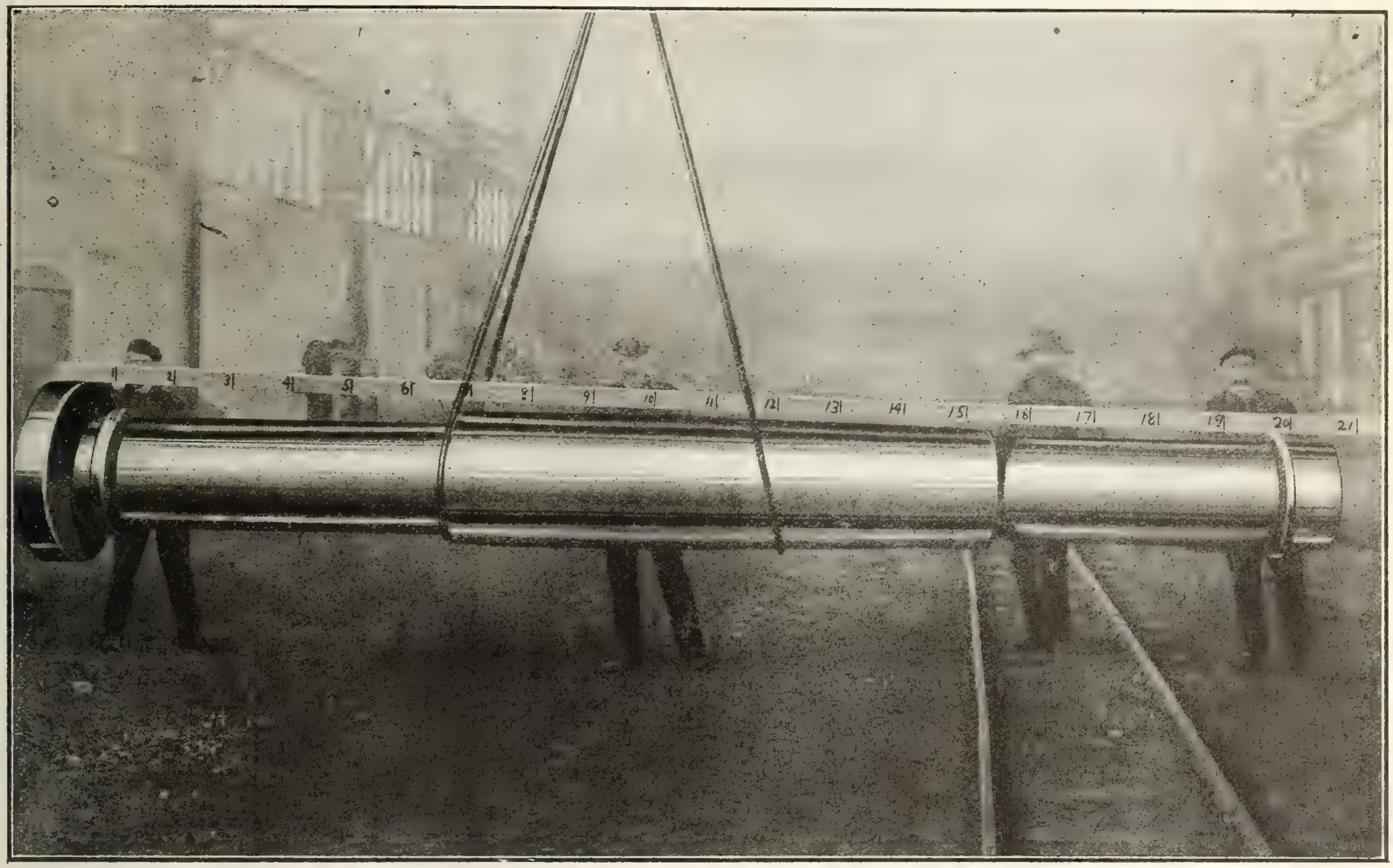

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A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World. Published by The MacLean Publishing Co., Limited

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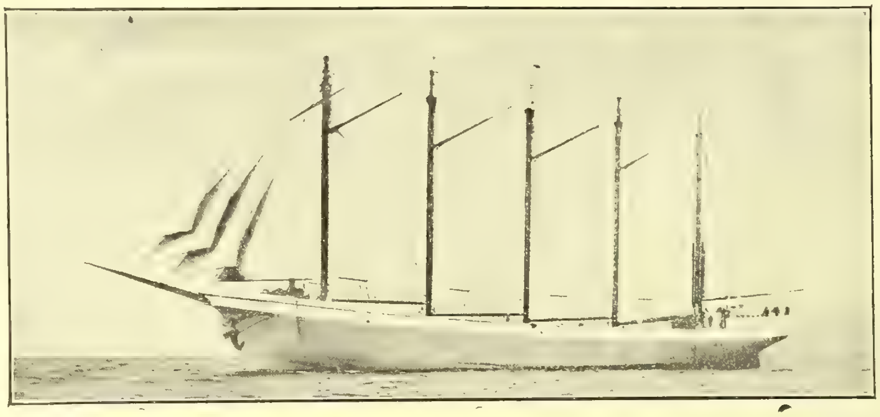

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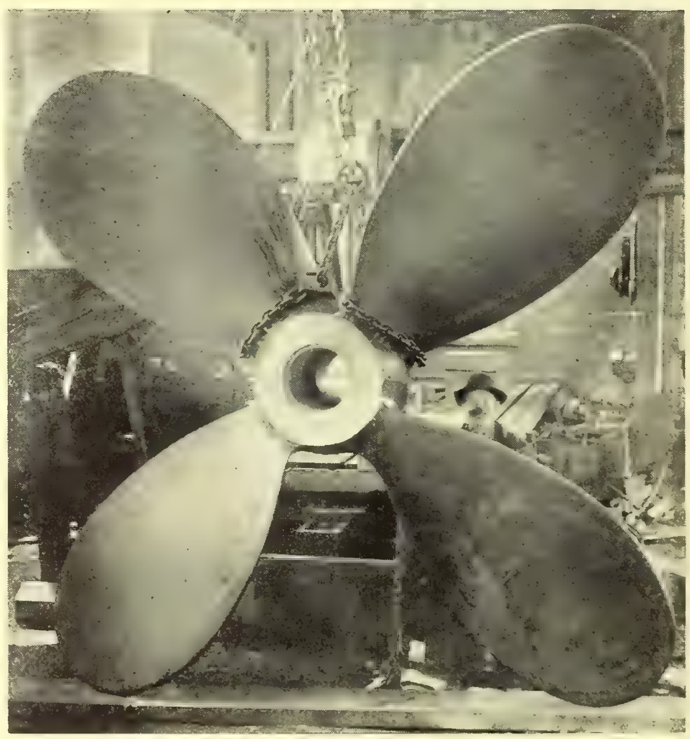

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Development of Ocean Service Shipbuilding in Canada--VI.

By C. T. R.

In addition to the widespread requisitioning of vessels for transportation purposes by the Allies, the war attendant and normal merchant ship losses and the many months' almost complete cessation of new construction on the part of the latter, the merchant marine of the world has had the misfortune to become to a large extent the target for enemy submarine activity. All nations have suffered in this respect, hence the almost feverish anxiety being displayed by shipping interests to have the losses made good at the earliest possible moment.

FREIGHTER "ORLEANS" LAUNCHED

PUNCTUALLY at noon on August 2, the bulk freighter Orleans was launched from the Thor Iron Works, Toronto, under the direction of Louis Dahlgren, general manager of the plant. The launching was a great success, and was witnessed by a large and appreciative crowd, among whom were many well known marine men, engineers and captains of industry. The christening ceremony was performed by Mrs. Stewart Playfair, who was presented with a bouquet of roses by the builders and a jewelled pendant by James Playfair. Among the guests present at the ceremony were: Mr. and Mrs. James Playfair, Mr. and Mrs. Stewart Playfair, Mr. and Mrs. Louis Dahlgren, Mr. and Mrs. Frank Barber, Col. J. B. Miller, Hugh Calderwood, R. A. Barber, George McKellar, John G. Kent, E. S. Cousins, W. Newman, Capt. Winstrup, Capt. J. B. Foote, Capt. Nillson, H. G. Kelly, Allan Scott, H. Langlois, J. B. Kilgour, Mrs. Charles Lee, Martin McCarron and Miss McCarron, W. W. Watson, John E. Russell, J. W. Woods, Mr. Reid, Col. Duff, F. C. Brunke, Mr. and Mrs. Kendall, Mr. Norman B. Gash, K.C., Harry T. McMillan, A. E. Gilverson, Prof. and Mrs. Treadgold, Mrs. Geo. McLeod, M. R. Gordon, Grant Gordon, Stanley McConnell, Geo. A. Mitchell, Ald. Donald C. MacGregor, John A. Montgomery, D. L. White (Midland), Fred. Hand, Capt. Wm. Evans, E. A. Mathews, Wm. J. Sheppard (Waubaushene), T. B. S. Benson, John G. Gwynne, Lloyd's surveyor; J. M. Wilson, A. G. Webster and many others.

STEEL FREIGHTER "ORLEANS" TAKING THE WATER.

The Orleans was originally ordered for the Great Lakes Transportation Co., of Midland, Ont., but was sold to the Oriental Navigation Co., of New York and Nantes, France, the latter being the port of registration. She has been built under Lloyd's special survey and classed 100A1, with carrying capacity of 4,300 tons. Length o.a. 261 ft.; breadth 43 ft. 6 in.; depth, 28 ft. 2 in.

A full description of the vessel appeared in our issue of December, 1916.

STEEL FREIGHTER "ORLEANS" ON WAYS JUST PREVIOUS TO LAUNCHING.

FISHERIES PROTECTION VESSELS LAUNCHED

TWO more vessels for fisheries protection service were launched at nine o'clock Thursday morning, August 2, from the Polson Iron Works, Toronto. These two vessels, the St. Eloi and Festubert, are the last of six of the same class, the others launched on June 16 being named respectively the Yypres, Vimy, Messines and St. Julien. The christening ceremonies were performed by Mrs. A. H. Jeffrey, wife of the secretary of the Polson Iron Works, who christened the St. Eloi, and by Mrs. Harry Miller, wife of the vice-president of the company, who christened the Festubert, both of whom were presented with a handsome bouquet of roses. The function was of a semi-private character.

EDUCATION OF MARINE ENGINEERS

THE Council of the Institute of Marine Engineers, having considered the subject of the future supply of engineers for the merchant service, and also the qualifications of men to fill the higher and more responsible positions, realizing at the same time the important part the marine engineer must play in the development of the British mercantile marine, is of opinion that these questions require the earnest consideration of State departments and all parties directly interested in the shipping industry, and that immediately after the restoration of peace, steps should be taken to ensure that the marine engineer of the future will be trained so that he may be thoroughly qualified to meet any calls demanded by his profession. The views of the council are embodied in the following report:—

Apprentice Education

We are of opinion that the present system of education is capable of considerable improvement, and the Board of Education or other educational authority should be urged to take steps to improve it.

1—By giving boys at the ordinary schools, up to the age of 14, a sound training in arithmetic, mathematics, drawing, elementary physics, electricity and chemistry.

2—By providing an increased number of junior technical or day trades-preparatory schools at which boys between the ages of about 14 and 16 years preparing to enter on a mechanical career may attend, and where the elementary teaching of the subjects cited above, and their general education, including languages, may be further developed.

3—By encouraging and giving facilities to boys during their apprenticeship to attend classes in mathematics, mechanics and engineering, so that this period of their lives will be devoted to a combination of their practical and theoretical education.

4—By the provision of scholarships so that boys of exceptional ability may, after serving for a period of, say, three years or more in the workshops, continue their studies in the more advanced technics of engineering, subject to the approval of their employers.

5—It is suggested that in large centres of industry it should be required that employers provide facilities during working hours for the technical education of at least a proportion of their apprentices.

Marine Engineers' Examinations

The examinations of marine engineers for first and second class certificates should embrace the technical subjects specified above and their application to practical engineering, and candidates should be required, as part of their qualification, to submit certificates or otherwise demonstrate that they have attained a certain standard of proficiency in mathematical and scientific knowledge.

The local or other educational authorities in all the large seaports should be urged to provide facilities in existing technical schools, or provide additional marine schools at which the course of study should be specially adapted for marine engineers preparing for their certificate examinations.

The requirements of first and second class engineers' certificates should be of a more exacting character, both as regards sea service and range of subjects set for the examinations, and a period should be set for the introduction of this higher standard.

Third Class B. O. T. Certificate

Simultaneously with the introduction of the higher standard of qualification, a third class Board of Trade certificate should be introduced.

The qualifications for examination for the third class certificate should be that the candidate should have the usual workshop training or its equivalent as now required for the second class certificate, together with one year's service at sea on regular watch, and the nature of this examination should be similar to the present examination for a second class certificate.

For a second class certificate the candidate should have a further sea service of twelve months in a qualifying capacity.

For a first class certificate the candidates should have a further sea service of eighteen months in charge of a watch.

Further to the proposals contained in the preceding paragraphs, we are of opinion that when the additional third class certificate is issued, the numbers of certificated engineers carried on the articles of all steamers should be revised.

Apprenticeship Period

We are also of the opinion that the qualifying period of apprenticeship should be at least five years. No time before the age of sixteen should be counted except in the case of junior technical schools, where time after the age of fourteen may be allowed at an appropriate value. Where the workshop service is performed in works where engines and boilers are made or repaired the following requirements are suggested:

Not less than 2½ years should be spent at fitting, erecting or repairing engines or machinery, either in the works or outside. The remaining 2½ years may be made up of time spent (1) at fitting, erecting or repairing engines or machinery; (2) at one of the other trades described below; (3) at an approved technical college. Time so spent to count as follows:—

Fitting, erecting, repairing or turning—Full time.

Working in drawing office—Full time up to two years, provided that an adequate period has been previously spent in the workshops, and beyond two years, half-time.

Pattern making—Full time up to twelve months; beyond twelve months, half-time, with a maximum allowance of two years.

Planing, slotting, shaping and milling—Full time up to a maximum of one year.

Boiler-making, repairing, or smith's work—Full time up to one year; beyond one year, half-time, with a maximum allowance of two years.

Coppersmith work—Full time up to a maximum of six months.

Brass or iron moulding—Half-time up to a maximum allowance of one year.

Attendance at an approved technical college—Two-thirds time: equivalent allowance to be made for attendance at junior technical schools.

In the event of the apprenticeship time being extended to six years or more, five years at turning, followed by one year at fitting or erecting, may be accepted as qualifying.

Where the workshop service is performed wholly or in part in works where engines and boilers are not made or repaired, it may be accepted if it is considered useful training for an engineer, but in such cases additional service must have been performed either in a marine shop or at sea, as enacted in the present Board of Trade regulations.

It has been suggested that licenses should be granted to "handymen" to enable them to take charge in low powered steamers, or to take charge of a watch in larger vessels. We are of the opinion that this is not desirable.

In this report, under paragraph 1, the education and training of the marine engineer have only been considered in a general sense. It is our opinion that this important matter should form the subject of consideration before a joint national committee representative of all the various interests.

DEVELOPMENTS IN CANAL BARGE PROPULSION IN BRITAIN

CONSIDERABLE interest has been displayed during recent months in an application of detachable motors to canal barges by a firm of English coal dealers. Experiments were commenced about a year ago and results have been so satisfactory that recently a special demonstration was made from Birmingham to London, a distance of 150 miles, with one barge in tow. The two boats carried approximately 25 tons of cargo each, and the trip was made at the rate of 2 miles per gallon, of paraffin. The total time taken was 64¾ hours, which also included passing through 144 locks en route.

The design as shown in Fig 1, is based on the familiar row-boat motor, with certain constructional changes and modifications rendered necessary by the increased power and weight. In this case the motor is carried on a suitable channel iron frame which is permanently attached to the top of the cabin, and is duplicated in all of the barges on which the system is applied. The propellor gear proper is supported by two stout brackets at top and bottom of a tubular casing, these brackets carrying the pintles which fit into sockets in the stern of the boat in the same manner as an ordinary rudder. The upper pintle bracket extends outward to support a

wooden socket pin into which the tiller is fitted, so that the propellor and gear are swung round as the tiller is operated to change the course.

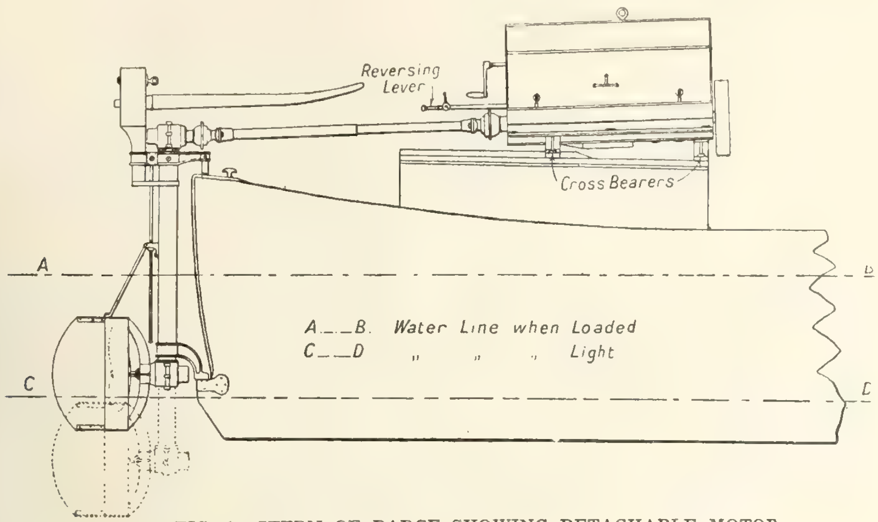


FIG. 1. STERN OF BARGE SHOWING DETACHABLE MOTOR INSTALLATION.

Draft Variation

An important modification of the gear rendered necessary by canal freight conditions is the adjustment for variations of draft. As shown in Fig. 1, the decrease in draft when light causes the propellor to be almost out of water and telescopic construction of the vertical shaft is necessary to allow of it being submerged as shown by dotted lines. This is done by ataching the propellor shaft bearing bracket to a tube which extends up inside the full length of the tubular casing so that at no time is its upper end liable to be under water. A slot on the rear side of the casing enables a bracket to be attached to this inner tube so that by means of a bevel operated screw shaft, the propeller can be adjusted to the desired draft. See Fig. 2.

The propellor is surrounded by a circular casing which is flanked on each side by a rudder blade, this duplex rudder, combined with the swivelling of the propellor, making the barge very sensitive to control. The overhang of the propeller and rudder is supported from the adjusting bracket by a diagonal stay as shown in the illustrations, so that the propellor shaft bearing bracket is relieved from this excess weight. The vertical shaft is of corresponding telescopic construction, the solid member being splined to suit the feather key secured in the hollow member. Bevel gears connect the various shafts, the horizontal shaft in the upper casing being connected to the engine by another telescopic shaft, fitted with a universal joint at each end to allow full play horizontally and vertically to the propellor gear.

FIG. 3. TELESCOPIC DRIVING SHAFT.

Rapid Demountability

By removing four bolts, this drive shaft is removable; other six bolts release the engine from its frame, and the propellor gear lifts clear out of the pintle sockets, enabling the transfer of the entire plant from one barge to another to be effected in less than fifteen minutes. The engine employed in these trials is a Sterling 4-cylinder marine type, developing 17 brake horse-power at 600 revs. per min., reduced to 425 revs. per min. for the three-bladed 22 in. dia. by 18 in. pitch propellor.

The engine, complete with its casing, self-contained fuel tanks, and flexible pipes for circulating water, weighs 672 lbs., and the propellor gear 280 lbs., and are transferred by a small hand derrick which fits into a socket on the side of the cabin on each barge, the derrick accompanying the plant.

It will be noted that the design allows for considerable variation in cabin height and location, depth of hull, etc., the only dimension calling for duplication being the position of the pintle sockets. Apart form these, however, there is sufficient latitude to enable quite a number of different boats being adapted for use with one power plant at a minimum cost.

Efficiency Cost

The total load capacity is 100 tons when towing two barges. The engine is started on gasoline, but is run on paraffin with a slight mixture of spirit substitute, the average cost working out a less than one cent per ton mile.

REMOVING IRON PLATE RUST.

AN easy, cheap and effective method of removing rust from corroded and pitted iron plates has been evolved as a result of recent practical experiments in this direction. The method consists in the application to the surface of the iron of a mixture of two parts of finely crushed sodium bisulphate and one part of common salt. This mixture is prepared, then wetted (just sufficiently to be cohesive), and applied to the plate. The moist mixture can be left till the plate is clean, but the action is more rapid if the mixture is scraped off every two or three hours and the iron scrubbed thoroughly with a wire brush and water. The treatment is repeated till the plate is clean. Usually twenty-four hours is sufficient for a badly corroded plate. When the plate is thoroughly clean, it is well washed with an alkaline solution and dried quickly. A coating of paraffin oil is at once applied to protect the surface against oxidation. This method is found to be more effective than hammering, chiseling, the use of wire brushes or even a sand blast.

BOILER REPAIRS BY OXY-ACETYLENE

REPAIRS to boiler plates, which formerly were made by cutting a piece of the original plate out with cold chisel, and riveting a new piece on, are now being performed by Canadian firms with the oxy-acetylene process, the plates being cut with the oxy torch and the new pieces welded into place, doing away with riveting, which in many cases is largely impossible owing to lack of room. Oxy-acetylene welding for boiler repair jobs has been employed with complete success in the U.S., and has replaced the ordinary methods almost wholly in locomotive shops.

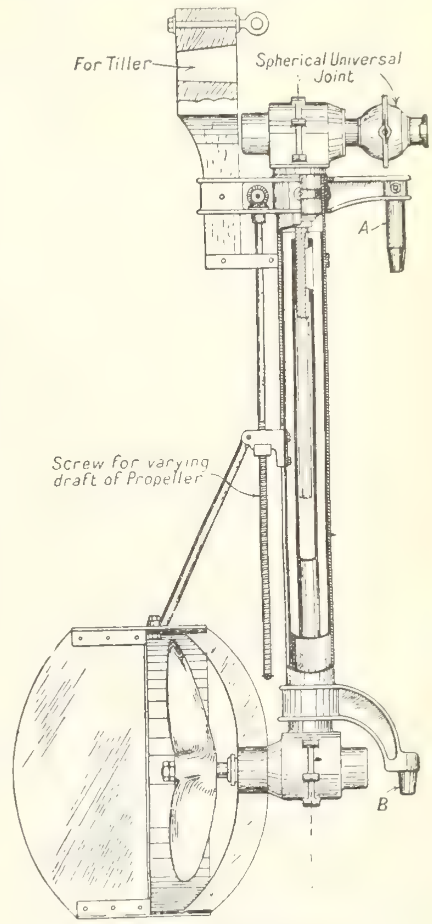


FIG. 2. DETAIL OF PROPELLING GEAR.

Practice of Oil Burning Under Marine Steam Boilers*

By B. S. Nelson

The scarcity and high price of coal for steam raising, etc., has naturally directed attention to the subject of oil fuel as a substitute. In recent years much progress has taken place in the direction of high degree efficiency of equipment for oil burning, and many installations have been made in consequence. While there is little prospect of an oil scarcity devloping, there is nevertheless a tendency for its price to soar, a very material increase being noted in the period covered by the war to date. Advantages of oil over coal, aside from cost, are dealt with in the accompanying article, and are worthy of close study.

FUEL oil is oil which is more valuable to the producer as fuel than as a refined product. Due to the rapid increase in use of gasoline in motor vehicles and the use of distillates in stationary engines, and also to the improvements in refining crude oils, it is probable that very little crude oil will be used for fuel, and that the fuel most used will be some sort of residuum or scalped oils; that is, being distilled and the residue used as fuel. The result of this will be that more attention will have to be paid to the oil-burning system than was necessary with the lighter crude oils used heretofore, because a scalped oil is heavier and more viscous than crude oil. One advantage in using a scalped oil is that there is less fire risk, because its flash point is higher than the flash point of the crude oil.

The flash point of an oil is of interest particularly from the standpoint of safety. On land installations, where the oil is usually buried in a closed tank, the flash point is of less importance than on shipboard, where inflammable vapors are apt to accumulate in the hull or to be freed in a closed boiler room, due to leaky piping.

The viscosity of an oil is the principal

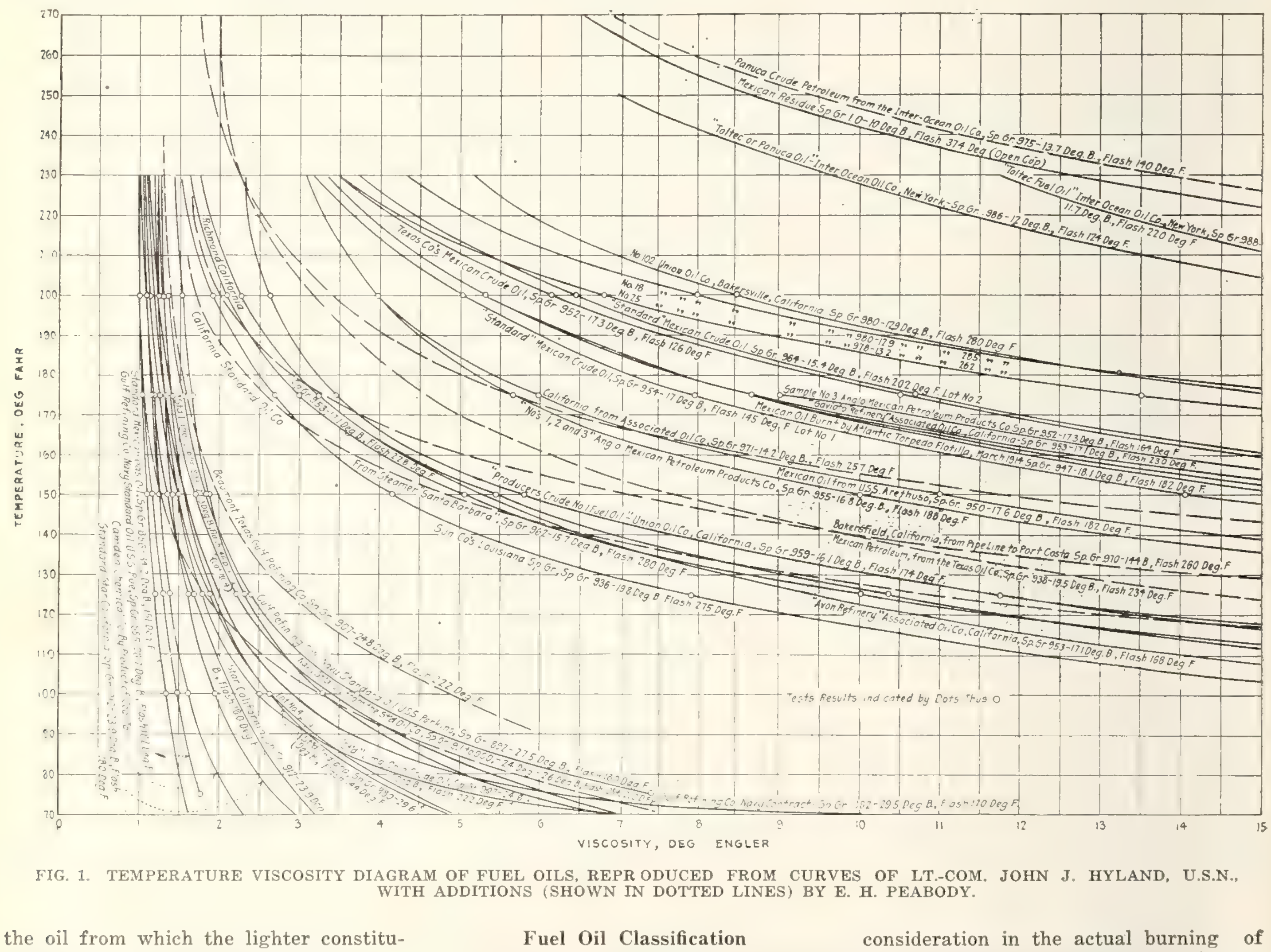


FIG. 1. TEMPERATURE VISCOSITY DIAGRAM OF FUEL OILS, REPRODUCED FROM CURVES OF LT.-COM. JOHN J. HYLAND, U.S.N., WITH ADDITIONS (SHOWN IN DOTTED LINES) BY E. H. PEABODY.

the oil from which the lighter constituents have been distilled off. Though the Mexican oils are, as a rule, heavier and contain less of the lighter constituents than American oils, even they are now

Fuel Oil Classification

Fuel oils may be classified according to several of their characteristics, which are more or less dependent upon each other. Some of these are the flash point, or temperature at which an oil will give off inflammable vapors; the viscosity, which may be explained as the molecular friction; the specific gravity, the heat value, and the sulphur content.

consideration in the actual burning of that oil, because the success of the burner or atomizer depends largely on its ability to atomize the fuel into sufficiently fine particles to insure satisfactory combustion, and the more viscous the oil the more difficult this atomization. There are various methods of expressing the viscosity, one of the most used being in terms of the Engler scale. Degrees

*From a paper presented at a joint meeting of the Louisiana Association of Members of the American Society of Civil Engineers and the New Orleans Section of the American Society of Mechanical Engineers.

Engler means simply the ratio of the time it takes a given quantity of an oil to flow through a standard orifice as compared to the time it would take the same volume of water to flow through. Oil is usually sold, however, on the basis of its specific gravity (generally measured in degrees Baume) and its heat value and moisture content. It is usually assumed that the heavier an oil in degrees Baume, the more viscous is that oil, but this is not always strictly true.

Through the courtesy of E. H. Peabody, Mem. Am. Soc. M.E., in Fig. 1 is reproduced a very interesting chart giving the characteristics of some thirty different oils. This chart gives the temperature-viscosity diagram of these fuels, the specific gravity, the degrees Baume and the flash point. Comparing two crude oils from these curves brings out the relation, or rather lack of relation, between degrees Baume and degrees Engler:

	Deg. B.	Flash Pt.	Deg. Eng. at 230 Deg. Fahr.
Panuca Crude	13.7	140	13.75
No. 18 California.	12.7	285	5.2

It is to be regretted that oil is not specified in terms of specific gravity instead of degrees Baume, because in any calculations involving the weight of the oil per gallon or per barrel it is necessary to refer back to specific gravity. Further, the heaviest oil that can be designated on the Baume scale for liquids lighter than water is 10 deg. B., or unit specific gravity. There are oils being used now of 10 and 12 deg. B., and no doubt still heavier oils will be used, which will call for two different Baume scales and cause confusion.

Spindle Top oil has a specific gravity of about 0.92, corresponding to 22 deg. B., and its heat value averages about 19,700 B.t.u. California oil is somewhat heavier, the average grade of that oil having a specific gravity of about 0.95, or 18 deg. B., heat value about 18,500 B.t.u. The Mexican oils vary considerably in specific gravity and heat value, but as a rule they are much heavier than either the California or Texas oils; a typical oil now used has 0.99 sp. gr., or 12 deg. B., with a heat value of about 18,200 B.t.u.

Table I compares the prices of coal and oil, taking as a basis coal of the quality of Pratt, Alabama, and Pittsburgh coal, sold in the New Orleans market. While with these coals an evaporation of 10 lb. from and at 212 deg. can be realized with well-designed water-tube boilers when the boilers have ample heating surface and are in the hands of skillful firemen, it is extremely doubtful if any boilers in regular service are showing better than 8 lb., and the great majority are below this figure. Therefore, if we take 8 lb. as a basis, we are giving the coal its full value. Now, with oil giving 19.500 B.t.u. per lb., an evaporation of 14.5 lb. should be readily obtained if the apparatus for supplying the oil to the furnaces is of first-class design and if the furnaces are properly arranged. With this ratio as a basis, it is apparent that a pound of coal is equivalent to 8/14.5 or 0.541 lb. of oil. A barrel of crude oil weighs approximately 325 lb., therefore one ton (2000 lb.) of coal is equivalent in practical heating value to 3.34 bbl. of oil.

TABLE I—COMPARISON OF PRICES OF COAL AND OIL.

Coal, Dollars per Ton, 2,000 lb.	Oil, Dollars per Bbl.	
5.00	1.50*	1.66†
4.75	1.43	1.60
4.50	1.35	1.50
4.25	1.28	1.42
4.00	1 20	1.33
3.75	1.13	1.25
3.50	1.05	1.02
3.25	.98	1.01
3.00	.90	1.00
2.75	.83	.92
2.50	.75	.83
2.00	.60	.66
2.25	.68	.75

*Not allowing for labor saving.

†Assuming 10 per cent. of cost of fuel in labor of firing and handling ashes saved by using oil, a conservative estimate for plants of over 300 h.p.

An interesting point to note with reference to the heat value of an oil is that the B.t.u. usually given is the high heat value or heat value determined in a bomb calorimeter. The actual heat value available in a boiler furnace is less because all fuel oil contains a considerable percentage of hydrogen, and the latent heat of the steam formed by the combustion of this hydrogen passes up the stack as waste heat.

In all the heavier grades of fuel, particularly the Mexican oils, water mixed with the oil is in the form of an emulsion and will not settle out in a tank as it will with the lighter American crudes. This is not so much a disadvantage as it would seem, other than causing a lowering of the heat value. With an oil light enough for the water to settle out of its own accord, this water will frequently accumulate in the tank and piping and go over into the burners in a slug, putting the burners out; but with heavy oil a very considerable amount of water can go through the burner with no bad effect. The writer is inclined to believe that a small quantity of water in heavy oil is an advantage in that these oils are usually heated above the boiling point of water to effect atomization, and the vaporizing of the moisture in the oil as it leaves the burner tip probably helps to atomize the oil more thoroughly.

Oil Advantages Over Coal

Oil has numerous other advantages over coal than cost of fuel. The storage space required is much less for an equal number of heat units; there are no ashes to be disposed of; less boiler-room help is required for firing; the wear and tear on the furnace lining is smaller because the firedoors do not have to be opened, with the consequent chilling of the hot brickwork. Very few repairs are necessary to the grate bars; a much smaller stack can be used for the same boiler horse-power; the boiler can be forced with natural draft considerably beyond what it can with coal, an important feature where boiler capacity is scant; where feedwater is bad, it is often possible to carry a load with two oil-fired boilers which would require three boilers were coal used, thus allowing the cleaning and repairing of one dirty boiler at a time. Steam can be raised much more quickly and with no loss due to banking fires. It takes about 10 per cent. of the fuel normally consumed by a boiler at rated load to keep its fire banked with coal. In case of an emergency the fire can be instantly extinguished; any one who has had to draw a hot coal fire in an emergency can appreciate this particular advantage.

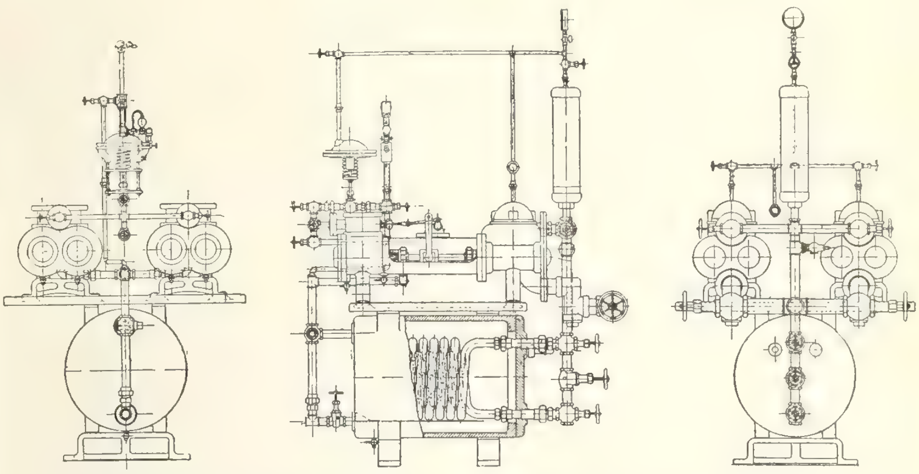


FIG. 2. OIL PUMPING SET, SHOWING DUPLICATE PUMPS WITH PRESSURE GOVERNOR, AIR CHAMBER, GAUGE, SUCTION STRAINERS, RELIEF VALVE AND HEATER.

Successful Oil-Burning Installation Data

There are several factors entering into the successful oil-burning installation, some of which affect the reliability of the system and others its efficient operation.

The first consideration for reliability is the oil supply to the burners, involving the storage tanks, pumping outfit, and heaters. The size of a storage tank varies, of course, with the size of the boiler plant, but it should be large enough, at least, to hold a carload of oil. A very popular size of tank is a 10,000-gal. tank, which is about 8 ft. in diameter and about 30 ft. long. These tanks are usually built of ¼-in. steel with ⅜-in. heads, though if the tank is subject to corrosion from the outside it should be made of heavier material. The tank should be equipped with a manhole and filling pipe, a suction opening, a vent opening, and openings for steam-heating-coil connec-

tions. The insurance requirements call for the tank to be below the level of the pumps and burners, which means that it is usually buried in the ground.

The Oil Pumps

The oil pumps are the next consideration. The pump that has given the best results is a duplex steam pump, piston-pattern type, with brass valves, metallic packing in the oil piston and special gaskets and piston-rod packing. The size of pump should be based on a very low piston speed.

The pump should be fitted with an air chamber on the discharge side to steady its pulsation of pressure, and a governor on the steam end to maintain the pressure constant. The pressure at which the oil is delivered to the burners depends largely on the character of the oil, varying from 40 lb. for oil of 26 to 30 deg. B. to 80 lb. for oil of 12 deg. B. The pump should also be equipped with strainers on the suction side to keep trash from getting under the pump valves. Duplicate pumps should always be installed, so that if anything goes wrong with one pump the other may be put in service.

The pump should be set as near the level of the oil as possible to give the minimum suction lift, and the suction pipe should be as straight as possible, preferably with bends instead of elbows. Where the suction pipe is long, a foot valve at the bottom of the suction line in the tank is desirable. This should be a valve without leather seats, as fuel oil deteriorates leather. A very good valve to use is a horizontal-swing check used in a vertical position. In addition to air chamber and governor, the pump should be equipped with a relief valve set at a pressure heavier than the working pressure, so as to minimize the danger of breaking the pump. This relief valve should be of the enclosed type, so that its overflow be returned to the tank.

The heavier oils require heating in the suction tank in order to enable the pump to lift them. The temperature must not be high enough to cause the oil to vaporize under the suction pull of the pump. The writer has found a temperature of 110 to 130 deg. about right for Mexican oil of 12 to 18 deg. B. According to Commander John J. Hyland, U.S.N. (*Jour. A. S. N. E.*, May, 1914), the viscosity of the oil had to be reduced to 375 deg. Eng. in order to obtain full capacity from a Blake pump. In order to gauge this temperature accurately, a thermometer should be installed in the suction line near the pump. If this suction line is long, or has several elbows in it, it should be made one or two sizes larger than the suction opening of the pump.

The Heater

The next question is that of the heater. Practically all the oil now burned as fuel requires heating in order to reduce its viscosity and facilitate atomization at the burner. There is a wide choice of heaters, but the principal considerations are, first, to have the heater of ample heating surface, and second, to be sure that this heating surface is all utilized In heating oil with a steam coil in a vessel of oil there is a tendency to local heating; that is, the oil next to the coils may be very warm; but this heat is not readily transmitted to the adjacent oil, so that a heater in which the oil is kept in rapid motion over all the heating surface in the coil is apt to give best results.

There are several pumping sets on the market which combine all the requisites enumerated above in one self-contained unit. Fig. 2 shows such an outfit which, it will be noted, consists of duplicate pumps with pressure governor, air chamber, gauge, suction strainers on pumps, relief valve and heater.

Oil Heating Temperature

The temperature to which the oil must be heated naturally varies with its viscosity. For fuel oil usually burned in the South, a temperature from 180 to 220 deg. is satisfactory, the higher temperature being for oil of 12 deg. B. As far as we know, no experiments have been made to determine the degrees Engler to which oil must be heated, but judging from our experience and with the aid of the temperature-viscosity diagrams, we should say that about 8 to 9 deg. Eng. is the viscosity required for a steam-atomizer burner. It has been stated, however, that any oil which can be pumped readily can be atomized by a steam atomizer. After the oil is heated at the pump (and its temperature should be read by a thermometer permanently fixed in the discharge line from the pumps), care should be taken to keep the oil hot until it reaches the burner by proper covering of the pipes.

Burner Feature

More stress has probably been laid on the oil burner than on any other part of the installation, which has led to the belief on the part of people unfamiliar with the burning of oil that the burner is the whole thing, whereas, as a matter of fact, the burner contributes but a very small part to the success of the installation. The term burner is really a misnomer, because the only function the burner performs is to atomize the fuel into sufficiently fine particles to effect complete combustion in the furnace.

For land installations, the type of burner which has proved best is the steam-atomizer burner with oil supplied to it under pressure. The essentials of such a burner are simplicity, cheaply renewable wearing parts, economy in steam for atomizing, and the production of a flame of such shape that makes good combustion and, hence, high boiler efficiency possible. The burners may be of either the round-flame or flat-flame type. The flat-flame type is preferable because it uses less steam for atomizing and produces a flame of such shape as to permit proper mixture of air to support combustion without excess air, which is not the case with a round-flame burner.

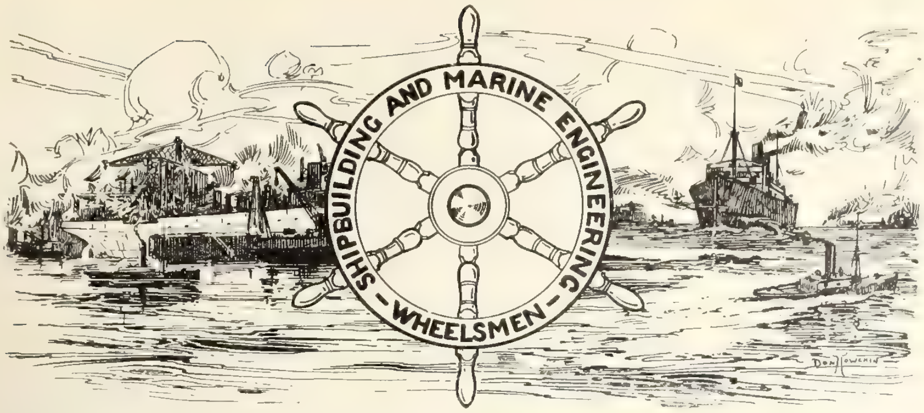
The use of a target wall is not necessary, and may cause injury to the heating surface of the boiler by causing the flame to concentrate on a small portion of the surface, resulting in what is termed "blow-pipe" action.

The general type of flat-flame burner is a tip in which are two narrow parallel and horizontal slots, the oil flowing out of the upper slot in fan shape on to the fan-shaped jet of steam issuing from the lower slot.

The position of the burner depends largely on the type of boiler. For a boiler with a long unobstructed furnace, such as a horizontal return tubular, or a boiler of the Heine or Erie City type, a burner set in the firing door is very satisfactory. For boilers where the furnace is short and the travel of the gases is upward, such as in the Babcock & Wilcox or Stirling boiler, the best arrangement is to put the burner at the back, shooting toward the front of the boiler. In either case air should be admitted to the furnace through a checkerwork of firebrick laid on the grate bars. The shape of this checker work should approximate the shape of the flame and thus reduce excess air, and the area of all the holes should be equal to 4 sq. in. per boiler horse-power.

Steam and oil connections to a burner should be made to allow for the expansion and contraction of the oil and the steam headers, and should have unions above and below the burner to enable the latter to be taken out quickly for cleaning. A very essential point in installing a burner is to see that it gets dry steam. The simplest way to do this is to take the steam from the top of the auxiliary steam header. A steam connection should be provided on each burner for blowing the oil out of the burner when it is shut down, as otherwise this oil will carbonize, due to the heat radiated from the hot furnace.

The principal consideration affecting the efficiency of an oil-burner installation, other than the choice of a burner economical in the use of steam (and giving the proper shape of flame), is the proper control of the air supply. One of the advantages of burning oil, mentioned above, was the possibility of reducing the excess air to effect combustion. Conversely, one of the principal losses is the ease with which excess air can be admitted. For any particular installation (assuming the setting is tight and checkerwork properly arranged), the best draft should be determined by installing a draft gauge on each boiler connected to the furnace, then gradually closing the damper until there appears just a faint trace of black smoke at the stack, and finally maintaining the draft at that point. It should be noted, however, that there can easily be smoke with excess air for two reasons: first, if the checkerwork is not properly arranged in the furnace there will be excess air, even though the combustion be incomplete, and second, poor atomization of the oil at the burner will give a grayish-white smoke, which is often mistaken for insufficient air. A more accurate method of gauging the air supply is to make periodical analyses of the stack gases and keep a record of the stack temperatures. The stack gases should not be over 100 deg. hotter than the steam, and no difficulty should be experienced in getting 13 to 14 per cent. CO_2 in regular operation.



The success of shipbuilding and marine engineering enterprise is largely dependent on its "Wheelsmen." This series of articles has for its object the featuring in a racy, interesting and instructive fashion, the personal training, experience and achievement of those who to-day in Canada are energetically and effectively navigating the twin craft to higher degree prominence in their capacity as designers, constructors, outfitters, etc.

JOHN WILKIE TAYLOR

THE increasing importance of the shipping industry, which is now being brought before the general public by events not of the pleasantest, is of more than passing interest to our readers, not only on account of the manufacturing activity which is expected to result from present developments, but also because of the more intimate knowledge ensuing with regard to ships' equipment and personnel. The part played by the machine shop in the annual round of marine life in this country is too important to be overlooked. Not only so, but the influence of early experience during the formative period of an engineer's life has more than a little to do with the ultimate niche which he may occupy in industry's gallery.

As chief engineer of the Western Canada Flour Mills Co., Goderich, Ont., John Wilkie Taylor occupies a post of considerable importance not only from a technical viewpoint, but also, at the present moment, from a standpoint of international exigency; a daily capacity of 10,000 barrels of flour by the various plants will perhaps facilitate perception of the reference. Despite the fact that he has a "shore job," Mr. Taylor's success has been largely influenced by a happy combination of constructive and operative experience. Born of Scottish parents at Nottawa, Ont., 1868, Mr. Taylor is Canadian to the core, his life activities having afforded opportunity for becoming intimately acquainted with many widely separated parts of his native land.

His early education was obtained in the public schools of Nottawasaga Township, passing the entrance examinations at 13 years of age. In May, 1880, an apprenticeship was commenced in the establishment of Nathan Veitch, ironfounder and machinist, at Nottawa, and although, as our "Spoke" remarks, the plant was somewhat primitive, the proprietor, by reason of his personal interest in the youthful employee, more than made up for the shortcomings of his equipment. Mr. Veitch was a real "old guard" of the trade, having come from the Howden shops in Glasgow, Scotland, and the thorough manner in which he grounded our friend in the rudiments of the foundry and mechanical trades has been the cause of life-long gratitude on the part of Mr. Taylor.

On the conclusion of his apprenticeship Mr. Taylor spent a year at Collingwood as assistant engineer in a large

JOHN WILKIE TAYLOR.

saw mill owned by the A. M. Dodge Co., of New York. His contact with shipping at this port created a desire for marine experience, and during the three seasons ending 1890 he was in charge of small craft plying from that port. A position as staff engineer with the Great Northern Transit Co. of Collingwood was followed in 1894 by appointment to the post of chief engineer in charge of the fleet of the Dominion Fish Co., Georgian Bay. This position he relinquished for a year to join the Holland and Emery Lumber Co., at Byng Inlet, returning to the former company and superintending the overhauling of their fleet while wintering at Goderich. The year 1900 was rendered memorable in our "Spoke's" life by the burning of the passenger steamer Persia, of which he was chief engineer. The event was not without its recompense, as he had full charge of the rebuilding of the engines, boilers and mechanical equipment, a task which was of considerable value in view of the experience obtained, as was evidenced by the performance of similar work for the Dominion Fish Co., in connection with their passenger steamer Manitou.

Recent events have acted as a forcible reminder of the three years from 1904 to 1907, which were spent as chief engineer on the steel freighter Algonquin, this craft having recently fallen a victim to the torpedo of a Hun submarine off the coast of England. Mr. Taylor at this time was a strong advocate for the adoption of quadruple expansion engines, and while a bulk lake freighter of 10,000 tons was so fitted at that time and demonstrated the efficiency of the type of engine, further adoption was negatived by the extra amount of space required. His admiration for this highly developed type of engine was given full scope, when after four years with the Montreal Transportation Co., he became chief engineer of the turret steamer Scottish Hero, of the Canadian Lake & Ocean Navigation Co. This vessel had quadruple expansion engines, and had been refitted with Scotch boilers for 215 lbs. pressure, the two years' operation of which provided additional experience of a valuable nature, calculated to render our friend particularly fitted for the control and direction of the extensive equipment for which he is now responsible, and to which he was appointed in 1913, resigning from an important appointment with the Merchants' Mutual Line to accept the position.

The practical experience outlined has been combined with frequent opportunities to study power plant conditions in the States as well as Canada, and Mr. Taylor speaks highly of the degree to which Western Canada industrial equipment has been developed. A feature of Mr. Taylor's success has been the extent to which he relied on self-tuition for acquiring his theoretical knowledge. During early days in lake service, the winter months were spent in machine shops, and evenings devoted to study, the benefits being evidenced by the steady progress in his profession. His advice, therefore, to the young sea-going engineer has the feature of personal success behind it. "I most strongly advise serving an apprenticeship in some good engineering shop along with a technical school training, and throughout life a diligent study of trade and engineering journals.

As is frequently the case with men

much occupied in industrial pursuits, Mr. Taylor has not given much of his time to political matter, being strictly independent in his views. He has, however, been a life-long member of several fraternal socities and a number of Masonic orders, and when he retired from lake engineering was made an honorary member of Midland Council, National Association Marine Engineers.

Mr. Taylor's private life is now spent at Goderich, where he resides with his wife and family on Lighthouse Street, his ability having descended to one son, who is serving in an engineering capacity with the Standard Oil Co. at Taft, California.

SCHOONER AND SUBMARINE

A WATERFRONT reporter in these days of war and censors can pick up much that is interesting in the way of news and gather the material for stories that might fill columns and be read with interest; but what's the use? The newsgatherers are only too anxious to do all in their power to keep the Huns in the dark as far as they are concerned, but down in their hearts they have an idea that those same Huns have ways of finding things out apart altogether from what appears in the public print. Captains of steamships that come and go from Halifax are very careful what they tell, and if they find they are talking to a newspaper man they close up tighter than an oyster. Occasionally, however, they group together among themselves and swap experiences. At one of these social gatherings a Herald reporter was present a few nights ago.

Deleting names and dates in such a manner as to satisfy our good friend the censor, the story will here be told of one of the captains visiting Halifax. It is an absolutely true story. The name of the captain and of his steamer would add to the interest of the story, but those cannot be given.

Not so very many moons ago, the captain left the port of Halifax with orders to proceed to a French port with materials for the French Government. He was without a gun. He exerted every effort to have a gun placed on his ship while he was here, but at that time there was a shortage of guns and of mountings so he had to sail unarmed. After an uneventful voyage he arrived one morning off the French port. There was nothing in sight, but one of those little topsail schooners that in peace times frequent the Atlantic coast of Europe. It was rather a disreputable little craft with patched sails, and masts and yards that looked as if they had not been scraped and oiled since the beginning of the war. The captain felt that all was well and that before night fell he would be safely docked.

"Something on Port Bow"

"Something on the port bow!" shouted the lookout. The captain levelled his glasses in that direction and saw a periscope rippling the water as it came towards him. It rose higher and higher until the whole top of the submarine was out of water. Right abeam on the starboard side another submarine had come to the surface and fired a shot at the steamer, quickly followed by a second and a third, each one coming nearer. The fourth shot carried off the top of the stack and the captain swung over the telegraph signal to "stop" and then to "full steam astern." When the way was taken off the ship he again swung the handle to "stop" and ordered all hands to take to the boats. In the meantime the disreputable looking old topsail schooner was drawing nearer making about four knots.

The submarine that had fired the shots came nearer as the men took to the boats and a big German with a megaphone ordered the captain's boat to come alongside. The order was obeyed. The commander of the submarine asked the usual questions in regard to the ship, from whence she came and what she carried. Then he inquired about provisions. Did the steamer have a good supply of canned stuff? Did she carry any liquors? The captain says that he told the German that he had just come from Halifax, and that Halifax was a very dry town, but the Hun couldn't take a joke. The steamship captain was ordered on board the submarine and two husky Huns were placed in the boat with orders to go on board the steamer and gather up some desirable stores before opening her bilge cocks.

Schooner in Action

On the submarine deck there were left the steamer's captain, the commander of the submarine, and two officers. By this time the old topsail schooner was not more than half a dozen cable lengths away and suddenly she came up in the wind and from her bow there spat a shell that sent the spray flying over the submarine. With a Hunnish curse the Germans dove for their hatch grabbing for the English captain as they did so, but he was too nimble for them and sprang into the sea. The second shell from the schooner caught the submarine fair amidships and the third just forward of the conning tower at the waterline. The pirate craft went with a plunge headlong, the last seen of her being her propellors twirling in the air. The schooner then turned her attention to the other German, but that craft had started to submerge at the sound of the first shot and evidently made good her escape.

The schooner picked up the captain. The Germans who had gone aboard the steamer surrendered without a struggle. The steamer landed her cargo safely and came back for more, but now she has a nice little gun all ready to do her own shooting, and will not have to trust to a patched-sailed windjabber that needs the scraping knife and the paint pot. At the same time the captain has a warm spot in his heart for that same old windjammer.—Halifax Herald.

NAVAL RISKS IN WAR TIME.

IN commenting editorially on the recent destruction of H.M.S. Vanguard, apparently by an internal explosion, the Engineer remarks that, in view of the circumstances in which the Vanguard met her fate, no definite conclusions are likely to follow the searching inquiry which is to be held. Most, if not all, of the officers who were intimately concerned with the ordnance equipment of the ship have lost their lives, so that theory and surmise will have to be dealt with in default of first-hand evidence.

The Treachery Feature

As is usual in disasters of this kind, one hears a great deal of talk about treachery. The responsible authorities may be in possession of facts which are not available to the public, and the secrecy that is essential in war-time renders it idle to indulge in speculation where no proved facts exist. When the Bulwark was blown up in the early stage of the war, the possibility of sabotage was accepted by a good many people, but, subsequently, there was an official announcement of the finding of the court of inquiry which showed the disaster to have been due to a pure accident. In the case of the Natal, no second announcement was ever made, a fact which was held in some quarters to confirm the popular theory of a German plot. On the whole, however, we are not inclined to attach much credence to the supposition that hostile emissaries are responsible for the loss of these ships. Cunning and utterly unscrupulous as we know our enemies to be, they would find it a matter of extreme difficulty to accomplish by underhand methods the destruction of a British warship, especially if it happened to be a member of the Grand Fleet. The Navy is thorough in all that it does, and in nothing is it more thorough than in the precautions it takes against espionage. In theory, it may be simple enough to think out divers means of perpetrating acts of sabotage, but in practice any such attempt would encounter formidable difficulties. Therefore, while the possibility of treachery cannot be ruled entirely out, we are disposed to share the more prosaic opinion that the loss of the Vanguard was due to an accident. Few who have considered the matter at all can have failed to marvel at the rarity of these naval disasters. Every warship, great and small, is a potential volcano. Vessels of the battleship type carry deep down in their hulls hundreds of tons of the most violent explosives, and the slightest oversight, not to say negligence, in the handling, housing, or care of this deadly cargo may be fraught with the most terrible consequences.

Peace Time Disasters Rare

Before the war, our Navy was singularly free from such misfortunes, an immunity which was no doubt largely the result of the painstaking care exercised in the manufacture and storage of ammunition, but what is customary in peace may not always prove practicable in wartime. Nevertheless, considering

the extraordinary circumstances, the quality of our munitions has been astonishingly high, and it is steadily rising, as we have learnt from recent statements by members of the Ministry of Munitions. The chemists, the engineers, and the factory hands are fully alive to the supreme importance of putting in the very finest work in their respective spheres while they are engaged in supplying our gallant sailors and soldiers with ammunition. As it is, officers of both Services have repeatedly testified to the uniformly good standard of the explosives they receive from the home factories. The percentage of defective material has become almost infinitesimal. In land operations, an accident due to a defective cartridge or shell is rarely very serious in its consequences, but, at sea, the conditions are wholly different. The decomposition of a single 4-in. cartridge may annihilate the mightiest battleship.

UNITED STATES TO LEAD IN SHIPBUILDING?

IN the recent purchase of 60,000 tons of steel ship plate by the French Commission, through J. P. Morgan & Co., at 6c a pound for hull plate and 8½c to 9c a pound for marine boiler plate, the attitude of the U. S. Government towards its Allies is clearly shown. Washington authorities were not satisfied with charges for plate over these prices, and the mills that have named minimum prices of 7c a pound for hull plate and 13c a pound for marine boiler plate to the Allies, were constrained to accept the Washington view, says the Wall Street Journal.

Plate mills could readily sell maximum capacity for another year on the basis of 12c to 12½c a pound for hull plate and at 10c to 11c for tank plate, so great is the demand at home and abroad; while marine boiler plate for forward shipment would readily command 16c to 17c a pound in the open market. Some mills have asked 20c a pound for boiler plates.

It will be recalled that the Navy Department secured a price of 2.90c a pound for ship plate from the steel manufacturers virtually under duress. The agreement was made between Secretary Daniels and President Farrell of the Steel Corporation, representing the steel makers; but some of the plate manufacturers declared at the time that they could not produce plate at that price and come out even, while others had only a small profit. Since that time, the productive cost has increased. It is claimed that even the Steel Corporation to-day has a profit of only $4 a ton in ship plate at 2.90c a pound. It is estimated that the cost of producing hull plate under present conditions is $60 a ton for some large mills and probably $70 a ton for mills that are dependent upon the open market for raw material.

Labor Cost at Steel Mills

A large percentage of the cost of producing iron and steel at any time is due to labor. Since the first of this year, the wage scale has been increased 40% to 50%, and labor efficiency has decreased 20% to 30% during the same time. Steel companies that have their own supplies of raw material, of course, have a lower cost than plants that must depend on the open market for their pig iron and other raw material. In ordinary times, the cost of converting pig iron into steel ingots ranges from $4 to $10 a ton. The cost is least where molten instead of cold pig iron is used. Today the minimum cost of conversion is several dollars a ton higher; one authority places the minimum to-day at $7 a ton. To convert ingots into billets, the cost varies from $4 to $16 a ton; the minimum to-day is believed to be not far from $7.50 a ton. Cost of rolling steel varies according to the amount of gas consumed in the reheating furnaces and also depends upon whether gas or oil fuel is used.

Steel plates are rolled from slabs—where the rolling is not direct from ingots—and slabs are made from ingots. There is a loss of 20% to 25% from the ingot to the plate due to the necessary cropping of the ingot. Ship plate costs more than tank plate because of the additional physical and chemical tests that ship plate must meet. The minimum cost of converting ingots into finished plate to-day is fully $20 a ton for ordinary plate and may be as high as $30 a ton for ship plate.

U. S. Plate Mill Outputs

Output of the plate mills to-day is at the maximum in the history of the industry, and more new capacity will soon be active. Jones & Laughlin Steel Co. has just started a new 128 inch mill at the Soho Works with a rated capacity of 15,000 tons of plate a month. Bethlehem Steel Co. will start new mills with a capacity of about 10,000 tons a month, probably in September. The new plate mill of the Carnegie Steel Co. at Homestead is expected to be ready to roll in November, but the two new mills of the Brier Hill Steel Co. and the 84 inch mill of the Youngstown Sheet & Tube Co. will not be ready for 12 to 15 months. Illinois Steel Co., Worth Brothers, Corrigan & McKinney Co. and the Ashland plant also are building new mills. When all of these mills are in operation, it is estimated that the United States will have a capacity to roll 430,000 tons of plate a month, of which about 230,000 tons will be ship plate. To-day the monthly rolling of ship plate is about 150,000 tons, or approximately 42% of the total output.

In recent weeks the United States Government has been receiving about 50,000 tons of plate a month from the Carnegie Steel Co., and with the Allies has been getting about 40% of the entire capacity of all of the plate mills. The embargo declared by the President against export of ship plate to become effective August 15, of course, is a step to husband plate resources for Government needs.

It is an interesting fact that some of the ship plate bought by the French Commission about two weeks ago, to be used to build war ships and barges to carry supplies on rivers and canals in France, have already been shipped, and the balance will be exported in September. We understand that it is stipulated in the Morgan contract that if for any reason exports are held up, and it becomes necessary to store the plate, that the mills will receive 90% of the purchase price. One of the mills has asked for an additional payment of $2 a ton a month for storage if warehousing becomes necessary. There are many thousand tons of plate already sold for export that remain at the mills or at the seaboard waiting Government licenses, but shipments to England France, Italy and Russia have gone forward without much delay. New inquiries from Japan and Italy, however, are still going begging.

It should be recognized that the plate mills have taken relatively few orders at the high prices current in the open market recently, but that the bulk of the merchant business has been booked at prices ranging from 4c to 5c a pound, and the large tonnage for the United States Government will be furnished probably between 2.90c and 3.50c a pound. Some mills contend that 4½c would be a fair price for government work.

When the plate mills now building are in commission, the United States will have capacity to produce 230,000 tons of ship plates a month or 2,760,000 tons per annum. This will be sufficient to permit the building of 690,000 tons of shipping a month, or 8,280,000 tons a year. In an emergency, tank plates can be used for the building of small boats, so achievements may be even greater than anticipated. The total capacity to produce all kinds of plate in another year will be 5,150,000 tons per annum. The United States will emerge from the war as the greatest shipbuilding country in the world; not even second to Great Britain, and if the success of the war depends upon ships—as it seems—the fate of the Teuton is sealed.

LAKE ONTARIO SHIPPING TRAGEDY

EARLY on the morning of August 8, eleven persons were drowned in Lake Ontario by the foundering of the coal schooner George A. Marsh, of Belleville, and a child died from exposure. The boat was coming from Oswego to Kingston, when a heavy gale set in, and about five o'clock the craft went down. The lighthouse-keeper at Simcoe Island reported the disaster. The schooner foundered between Nine Mile Point and Pigeon Island. Four of the schooner's occupants took to a boat, but one was lost overboard.

Fundamental principles are the foundation on which the engineer builds. A solid foundation insures the security of the superstructure.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S.S. "CLEMATIS" STRANDING

A FORMAL investigation was held in the Court House, Halifax, N.S., on July 12, 1917, before Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Commander E. Wyatt, R.N.R., and Capt. T. A. Hill, of the R.M.S.S. Chaleur, acting as nautical assessors, into the cause which led to the stranding of the S.S. Clematis near Red Cape, Framboise, C.B., on June 15, 1917.

W. A. Henry, K. C. appeared for the master, on behalf of the Imperial Merchant Service Guild.

The master, Joseph Owen Williams, deposed that he was 34 years of age, holding a master's certificate; that he had been 7½ years in command; that the Clematis is a single-screw, steel ship of 2,160 tons register, and 3,406 tons gross; and carrying a crew of 37, including two certificated officers and two certificated engineers.

According to his statement, the compasses were adjusted 2½ years ago; a deviation of 8 degrees was the greatest found. Prior to the grounding, the vessel was in fog for three days and no observations were taken; he had been on deck most of the time; the ship being kept at reduced speed, until, on June 16, several casts of the lead were taken and a chain of soundings—which was produced in Court—was made.

At about 6.00 p.m. or shortly after, a cast showed the ship to be in 11 fathoms and immediately she was steered on the opposite course for about 10 minutes, when a whistle was heard, which was assumed to be the fog horn from Scaterie Island Light House. It bore west about one mile distant, and the vessel's course was again changed, this time to the northward, in order to clear the reef at the eastern end, Commandiere Reef.

At or about 6.50 p.m., a sound of ripples was heard and rocks were immediately seen on the starboard bow, the engines were ordered full speed ahead from half speed, with a hard to starboard order and the ship struck. The fog was very dense at the time, a look out was being kept and the master was on the bridge with the second officer. A stream and kedge anchor were laid astern, after having lowered the boats primarily. The engines were put full speed astern to no avail. The tanks were sounded and when water was found to be making, the pumps were set in operation. There was no spare bower anchor and the bowers at the hawse pipes could not be utilized, as the boats could not reach them on account of surf. After having been informed of his position by local fishermen, it proved that he had been mistaken in his assumption of the nature of the fog horn he heard.

The second mate, second engineer and others having been examined, the chief officer stated that there was 3 degrees deviation on the compass on northerly and westerly courses, which was confirmed by the captain, who was recalled.

Finding.

Having reviewed the evidence, the Court found that the master was foolhardy when, at first obtaining a sounding, of 11 fathoms, he did not, for a longer time, sail on the opposite course and sound until he was in safe waters; instead, the moment he had reversed his direction, he heard a whistle or fog horn, and came at once to the conclusion that it was Scaterie. Acting on that assumption, he again altered his course to north, increasing the speed of the ship. If, as he states, he heard the fog horn on the starboard side, he should then have hard ported his helm and brought the sound to his port side, sounded and then stopped when the soundings had deepened. Too much speed was also kept on the vessel in such a locality in thick fog.

In concluding, the Court found the master in default, not for negligent navigation, but for error in judgment regarding the fog horn and in maintaining too high a speed for the climatic conditions. His certificate was not dealt with in view of his previous faultless navigational work, but a severe reprimand awarded. It did not appear that the officers were negligent in their duties, and they were exonerated from blame.

"IMPEROYAL" — "MAISONNEUVE" COLLISION

IN the Shaughnessy Building, Montreal, on June 18 and 19, 1917, an investigation was held in the Wreck Commissioner's Court, before Capt. L. A. Demers, Dominion wreck commissioner, assisted by Capt. Francis Nash and Capt. Chas. Lapierre, acting as nautical assessors, into the causes which led to the collision between the S.S. Imperoyal and S.S. Maisonneuve near the intersection of Contrecoeur Range Lights on June 5, 1917, about 10.30 p.m.

A. R. Holden, K.C., represented the interest of Messrs. Dale & Company, while Messrs. W. J. White, K.C., and A. W. F. Buchanan, K.C., appeared on behalf of the owners of the Imperoyal.

Captain Robert Flack, of the Imperoyal deposed that he held a masters' certificate, No. 041855; that the Imperoyal is a single-screw steamer of an average of 9½ to 10 knots, drawing between 19 and 20 feet; that he had been in these waters only a few times; that he took a pilot at Quebec; that the weather was clear, with no wind, the lights being plainly seen, and his own being burning brightly.

He stated he was bound to Montreal with a cargo of oil; that he was on deck with the pilot and third mate, and kept a good look out on the bridge, besides having the look-out man on the forecastle head. When a certain distance from Buoy 45, he saw the green light of a vessel on his port bow, and one blast of the whistle was given, which was answered by two blasts from the vessel showing the green light, and full speed astern was given and the collision occurred. He thought his ship was stemming the current, which was about 3 miles, and was going over the ground 3 or 4 miles an hour. His ship came still in the water and was so when the collision occurred.

Captain Jean Pacquet, of the Maisonneuve, stated that the weather was clear, with no wind; that a certain distance away he saw two red lights, thinking that the ship showing them was disabled and having heard one blast from that vessel, he immediately answered by two blasts and hard-a-starboarded the helm, having then realized that the incoming vessel was under weigh, he ordered the engine room to put its fullest speed ahead by ringing the jingle bell. The collision ensuing caused his vessel to list over the port side on to the deck, and he gave orders to jump to the other vessel's deck, which was done promptly by all hands, the ship being left with her engines going full speed. Three of the sailors returned to the "Maisonneuve" to get their clothes, and the vessels became separated, and the three sailors steered the Maisonneuve, circling around the stern of the Imperoyal and finally beaching her.

Captain Paquet remained on board the Imperoyal, talking with the master of that vessel. When he heard the one blast, he was at 400 feet distant from the other ship. He avers he never saw the bright lights or masthead lights of the Imperoyal. He further stated that his vessel was of wooden construction, with compound engines; that she carried a crew of eight men; but had no officers, his son attending to the steering. She was bound from Montreal to St. Genevieve, but his intention was to call at Lanoraie. This vessel had no license to carry passengers, but on this occasion he had two friends and a child on board, in addition to the crew.

Pilot Severe Perrox, on the Imperoyal, stated that he held a license as

pilot for 21 years; that he was on the bridge with the captain, and saw the green light of the Maisonneuve some distance away, and he kept his course slightly to the northward of the channel, the range lights astern in one and the range lights of Contrecoeur slightly open to the northward; that on approaching further, he sounded one blast signal, which was answered by two from the other vessel; that he ported, then straightened up the helm, and ordered the engines full speed astern, the collision following; that his vessel struck the other on the starboard side in an oblique manner, nearly right angles, and he dropped anchor to prevent his vessel from going ashore. Additional evidence was also heard from the first officer and chief engineer of the Imperoyal and the wheelsman of the Maisonneuve.

Finding

The Court, having carefully reviewed the evidence adduced, finds that the Imperoyal was being navigated with improper lights, that is to say, the additional red light which was exhibited with the red side light was contrary to the regulations governing sailing lights of steamers, and was, therefore, misleading, the Court failing to find any regulations which direct a vessel carrying dangerous goods to exhibit additional lights than those prescribed for a ship under weigh.

Regulations which are for harbours solely have been enacted, but they do not apply to vessels outside the limits of ports, or whilst sailing, so that notwithstanding the nature of her cargo, the Imperoyal had erred against the spirit and the letter of the rules of the road, and the master is, therefore, censured for what is claimed by the Court to have been a wrong action in carrying this light. With respect to the pilot, the Court holds him in default, but only reprimands him for not seeing that only the proper sailing lights were exhibited.

The Court decided that the evidence proved the captain of the Maisonneuve to be incompetent and cancelled his certificate; and further imposed a fine of one hundred dollars for carrying passengers illegally.

S.S. "TURBINIA" STRANDING

THE causes which led to the stranding of the Turbinia in Niagara River, June 30; Centre Island, July 1; and in Toronto Harbour, July 5, 1917, were the subject of a formal investigation, held in the City Hall, Toronto, on July 20, 1917, before Capt. L. A. Demers, Dominion wreck commissioner, assisted by Capt. James R. Foote, and Capt James McMaugh, acting as nautical assessors.

Robert I. Towers, B. A., appeared on behalf of the owners of the Turbinia.

The master, Capt. Arthur Jeffreys, certificate No. 7246, stated that the Turbinia was a triple screw, steel ship, with turbine engines, capable of a speed of about 16 knots, 602 tons net, 1,064 tons gross, carrying a crew of 45 all told, including one certificated deck officer, besides himself, drawing 5 feet forward and 9 feet aft. He had been on this vessel as an officer about 11 years ago, and had only one day's notice of his appointment as master and joining the ship, therefore, he did not have time to examine and inquire into all details.

He averred that on the trip from Hamilton he had found the compass erratic, and advised the company to have same adjusted; that he noticed there was no line for the log, and, therefore, it was not used; that it was not usual nor customary to use the log on short runs and he did not make any demand to be supplied with the necessary line.

He deposed that he was ordered to Queenston in the Niagara River; that whilst coming over to Lewiston, in the face of a fresh north wind and down tide; that he evoluted to the best of his knowledge, not having been in this locality before, in order to reach Lewiston, under the influence of both wind and tide, his ship grounded, but suffered no damage.

He stated that passengers were taken on board and on July 1, a departure was made for Toronto; that shortly before reaching the buoy at the entrance of the Niagara River, the weather became thick, preventing him from taking bearings in order to ascertain the deviation of his compass for the course he was to steer, N.W. by N. ½ N.; that he continued on full speed, in the thick fog, timing the speed of his ship, which was purely an assumption, allowing 16 knots; that he thought he heard a fog horn; that he absented himself from the bridge for a period of twenty minutes, leaving the chief officer in charge of the watch.

He said that the lead line was ordered to be made ready; but was not used; that the fog horn of the station on Hanlan's Island was not heard; that he detected some concrete construction which appeared through the fog; that he had checked his speed to half previously, and upon the sudden appearance of this construction, he rang full speed astern; but the ship grounded, at 10.45 a.m., remaining ashore until 5 p.m. He estimated the ship was making from 4 to 6 knots at time of stranding. He had a look-out stationed on the forecastle head, besides the second mate, who had posted himself at that place.

On July 5, whilst coming from Toronto, outward bound, he saw in the harbour or passage to same, a number of small vessels on his port side, and he had to make room to pass them, and in so doing he grounded his vessel on the starboard side of the passage, going dead slow at the time.

In addition to evidence from various members of the crew, Capt. Chapman, of the life-saving station, the lighthouse keeper, and Capt. Trewer, compass adjuster, also gave evidence.

Finding

The Court having carefully reviewed the evidence adduced in these cases, finds that on June 30, the grounding was due to an error of judgment on the part of the master, Arthur Jeffreys, in miscalculating the force of current and wind, whilst crossing the Niagara River from Queenston to Lewiston. There was a current running down with a strong wind against it, and while manoeuvering in the river, of three-quarters of a mile in width, the ship had practically no headway, but existing local and atmospheric conditions contributed to the grounding. In this case, the error of judgment was not of a culpable nature. The master being in command only a few days did not have sufficient time to study and learn the actions of his ship, under various speeds, and her steering, hence the Court does not find him in default.

With respect to the grounding on Hanlan's Island, on July 1, he sailed from Lewiston early in the morning, the fog which came on prevented him from taking exact bearings in order to shape a course for Toronto. He had observed that his compass was erratic when fine weather prevailed; but never took means to ascertain its deviation by swinging the ship. He also noted that there was no log line attached to the log.

While the Court was of opinion that the master eliminated from his programme of duties and responsibilities, three elementary factors, 1st, doubt of compass exactness, 2nd, fast speed in a fog, 3rd, the non-usage of the lead, there are many things which cause the Court to use leniency and indulgence, and will suspend his certificate for one month from July 20 to August 20, 1917.

The Court opines that the mate might have made some suggestions towards reducing speed or using the lead, and hopes this comment may cause officers to show more ambition, if such is lacking, in view of the conditions. It absolves the mate from blame for the strandings, but remarks his conduct indicates indifference.

With regard to the grounding on July 5, the evidence is not very clear, as the master says a number of small boats were almost blocking the channel, and in endeavouring to clear them, his ship grounded, while the wheelman said he saw no boats, nor did the second officer. The ship was going slow, and, accepting the master's evidence as to the small vessels, the Court finds that he is not in default for this grounding, under the circumstances.

U-BOAT CHASERS MAY BE DISCARDED

ABANDONMENT of its original programme of building a great fleet of submarine chasers as rapidly as possible is contemplated by the U. S. Navy Department, and this action is considered the first step in shaping a new policy to meet the U-boat menace. While it is impossible to state the precise reasons prompting the department, it is believed that Vice-Admiral Sims has reported that the method now followed by the British Navy will never dispose of the submarines and that the General Board agreed with his recommendations. The department will continue to build des-

troyers with all speed, the navy being satisfied that this type of ship is of infinitely more value in fighting submarines than the wooden chasers.

Great Britain has thousands of the latter patrolling the war zone. The records of shipping destroyed by submarines shows that while the patrols have assisted in holding the sub-sea campaign in check, they have not reduced it to any considerable degree, and there is no reason for believing that they can ever eliminate the submarine as a serious military factor.

U. S. Flotilla Planned

When the United States entered the war, the department prepared comprehensive plans to turn out standardized wooden speed boats just as fast as small yards on both coasts could complete them. The British Government had already purchased hundreds of these craft in the United States and thus caused American plants to treble their facilities.

It was understood that within a year the United States would have more than 1,000 of the chasers patrolling the Atlantic Coast and assisting the British Navy. The department will however, accept the first batches and they will probably be shipped to England immediately, but as far as can be ascertained that will end the Government's investment in wooden chasers.

The first effect of the discontinuance of chaser building would be to release hundreds of shipbuilders for other work and to make construction material available for other tonnage. The Government also is expected to place as much armament as possible upon every American merchant ship and to avail itself of the new batch of destroyers to act as convoys. The department has repeatedly called attention to the fact that submarines have never managed to sink American armed ships which have a tolerable speed rate. The fact is attributed to the department's policy of putting plenty of good guns, with crack crews, on American ships.

An official announcement made in London recently stated that only 300 British ships were armed. Relatively the United States has a much greater number of armed ships. Great Britain, however, within the last few weeks has ordered a new flotilla of chasers from American firms.

BURNING OF MOTOR SHIP SEBASTIAN

NOTWITHSTANDING the accepted success of Diesel-type motors for ship propulsion, there are numerous critics on the lookout for any opportunity to depreciate their success and the recent burning of the British oil-carrying tank motor ship Sebastian off Nantucket Shoals may influence such persons to further criticism. The following statement by an official of the Netherlands Engineering Co. is of timely interest, particularly when it is pointed out that an internal combustion engine, especially one using residual oil-fuel, is manifestly safer against fire than any other power plant.

Vessel Service Record

The Diesel-driven motor ship Sebastian (7,200 tons displacement), after conversion to her present engines, was placed in service at the end of last June, since when she has covered approximately 40,000 nautical miles at an average speed of almost 9 knots, without a single breakdown, cylinder crack, or piston crack, cylinder-head crack, crank shaft fracture, etc., although she has been worked harder than a steamer in the heaviest of Atlantic weathers.

The total number of engine stops at sea (accessory adjustments only) in nearly ten months amount to four hours with one engine, and five hours with the other engine; also six hours with one engine when salt water got in the lubricating oil and had to be cleaned out. The mileage covered would have been about 3,000 miles greater had she not been held up in England for fifteen days having certain alterations to her deck structure previous to her last outward voyage.

Fuel consumption of the two main engines together has averaged under six tons (42 barrels)for twenty-four hours, with the engines averaging a fraction under 1,000 indicated horse-power each at 115 revolutions per minute. This figures out at 0.27 lb. per indicated horsepower hour, or just over .4 of a pound per shaft horse-power. In her hold she carries 4,100 tons of cargo.

On this last voyage to an American port both her Diesel engines ran for sixteen days and nights without a single stop, voluntarily or otherwise, averaging 8.8 knots in most heavy seas and adverse winds. On this voyage three of her engineers were entirely inexperienced with oil engines.

In nearly ten months the main bearings have worn down 1/128th part of an inch. The crank-pin bearings, although opened out for examination at regular periods, have only been readjusted once in ten months, the wear showing .2 mm. The crosshead bearings have been readjusted to .3 mm. in the same period. Compressor piston rings are the same which came out with the ship, and show hardly any wear at all. A few of the main piston rings have been renewed, but this has been mostly due to breaking them when springing them off the pistons for cleaning purposes. The cooling pump valves are as good as the day they were put in, some ten months ago.

Furthermore, the Diesel engines, which were built by Werkspoor, of Amsterdam, were not run or tested in the shops. They were built, sent to England in packing cases, and installed in the Sebastian, which was given a few hours' sea trial, and sent on her maiden voyage, arriving in New York in sixteen days.

Screenings

Feared the Worst.—An Irishman coming out of ether in the ward after an operation exclaimed audibly: "Thank God! That is over!' "Don't be so sure," said the man in the next bed. "They left a sponge in me and had to cut me open again.' And the patient on the other side said: "Why, they had to open me, too, to find one of their instruments." Just then the surgeon who had operated on the Irishman stuck his head in the door and yelled: "Has anybody seen my hat?" Poor Patrick fainted.

* * *

Not Much to Ask.—The landlady bustled up to her new lodger as he came down to breakfast the first morning.

"Good morning, sir," she wheezed.

"Good morning," said the lodger.

"I hope you've had a good night's rest," said the landlady.

"No," said the mild-mannered little man. "Your cat kept me awake."

"Oh," said the landlady, tossing her head, "I suppose you're going to ask me to have the poor thing killed."

"No-no, not exactly," said the gentle lodger. "But would you very much mind having it tuned?"

* * *

Hoaxing a Bishop.—Funny stories are told about Archbishop Trench, who, seeing one day in Dublin a little girl trying to reach a door-knocker, came to her assistance.

"Rap hard!" said the little innocent. He did so.

"Now, run like the very devil!"

Trench always feared paralysis. One day at a dinner party he started probing his knee with his fork, and not feeling any pain, exclaimed: It's come at last, I am afraid."

"It's my knee," said the lady next to him!

* * *

The Scotch of It.—An enterprising drummer attempted to bribe an old Scotch merchant by offering him a box of cigars.

"Na, na," said the old chap, shaking his head gravely. "I canna take 'em."

"Nonsense," said the drummer. "If you have any conscientious scruples you may pay me a quarter for the box."

"Weel, weel," said the old Scot. "I'll tak' two boxes."

* * *

Hotel Advertising.—The customer at a London hotel gazed at his plate.

"Waiter," he called. "I should like to know the meaning of this. Yesterday I was served with a portion of pudding twice the size of this."

"Oh," said the waiter. Then, after a moment: "Did ye 'appen to be sittin' by the window, Sir?"

"Yes."

"Then that accounts for it," he said confidently. "We always give people next the window extra helpings."

Accessory Equipment of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that determined effort is being put forth to initiate not only the design and construction of standard type ships for specific services, but that of their motive power—main and auxiliary reciprocating steam engine equipment, as well, with a view to acceleration of output and higher duty sea performance, this series of articles, describing and illustrating at least the more important instruments and accessory apparatus of the engine and boiler rooms seems to us more or less timely. The detail features of the various mechanisms will be discussed at length, also their specific application and utility scope.

CONCERNING INDICATOR DIAGRAMS—IV.

In our July number, the features of the steam expansion curve, cylinder clearance, characteristic cards from a variety type engine, also the occurrence and causes of faulty diagrams,

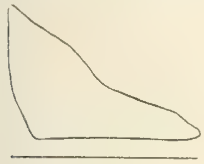


FIG. 14.

FIG. 15.

were dealt with at some length. A further discussion of the latter constitutes the introductory section of the present article, followed by an extended reference to the procedure followed in indicating compound engines, and combining the resultant diagrams.

Faulty Diagrams

Steam Throttled During Admission, Fig. 14.—When steam is throttled during admission, the steam line drops instead of being horizontal, indicating that the steam port is not open for a sufficient time.

Cut-off Too Early, Fig. 15.—The steam expands until its pressure is less than the back pressure, and the expansion line crosses the back pressure line to form the loop (g). This is frequently found, on automatic cut-off engines working on light load. On such engines it is caused by too high steam pressure and wastes steam for the amount of work done, besides causing reversal of pressure and pounding. It cannot be remedied by re-setting the valve. Steam must be throttled, the back pressure lowered by running condensing, or the engine run slower. The dotted line shows the result of slowing down the engine and cutting off later. This diagram shows also the result of too early compression. The steam is compressed in the clearance

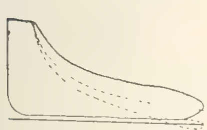


FIG. 18.

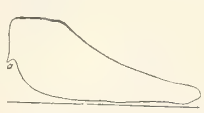


FIG. 19.

space until the pressure rises above that in the steam chest.

Cut-off Too Late, Fig. 16.—This is characterized by a high pressure at release, and means a big waste of steam due to its inability to do more work by expansion before the exhaust opens. The boiler pressure should be raised so that a diagram of equal area may be obtained with an earlier cut-off, or the revolutions of the engine increased, and the

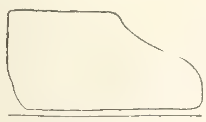


FIG. 16.

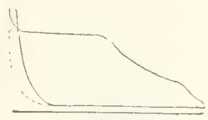


FIG. 17.

cut-off made to occur earlier.

Compression Too Early, Fig. 17.—When compression takes place too early the pressure in cylinder rises above that in the steam chest, and may cause chattering of the valve, pounding and heating, in addition to reducing the effective work of the steam. The dotted area plus the loop indicate the additional work obtained by setting the valves for proper compression. A similar loop may be caused by the absence of load on the steam valve, but when this fault occurs, the loop comes to a sharp point at the top.

Leaks Indicated by the Expansion Line, Fig. 18.—If the expansion line is noticeably above the theoretical adiabatic expansion line, steam enters the cylinder through a leaky valve after cut-off. If the expansion line falls below the theoretical, steam leaks past the piston, or gets out through a leaky exhaust valve.

Leaks Indicated by Compression Line, Figs. 19 and 20.—The curvature of the compression line changes as the piston nears the end of the stroke, sometimes even forming a hook. This indicates the escape of steam from the compression space, either through the exhaust or past the piston.

Condensation and Re-evaporation in Cylinder, Fig. 21.—If the expansion

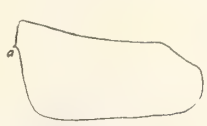


FIG. 20.

FIG. 21.

curve falls below the theoretical adiabatic line at the beginning of the stroke, crosses and then goes above, it is a fair sign that excessive condensation occurs at the beginning of the stroke, and re-evaporation during the latter part. Superheated steam will remedy such trouble and restore the expansion line to the normal position.

Very Bad Diagrams, Fig. 22.—There is here shown the worst imaginable distribution and waste of steam. The admission is late, there is almost no cut-off, and the steam port is opened so gradually that full steam pressure is not attained until the end of the stroke. The exhaust opens slowly and atmospheric pressure is not attained until two-thirds of the back stroke has been completed. Fig. 23 shows a similar exhaust line, due in the particular case to excessive back pressure from the feed water heater.

Indicating Compound Engines

Indicator diagrams of compound engines are taken in the same manner as on simple engines. Three cards are shown, Fig. 24, taken from a triple expansion cross-compound Corliss engine. The cards for the different cylinders are taken with different scale springs in or-

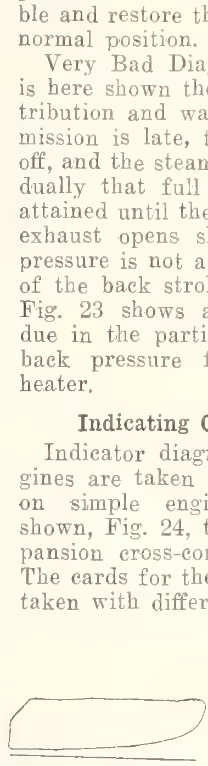


FIG. 22.

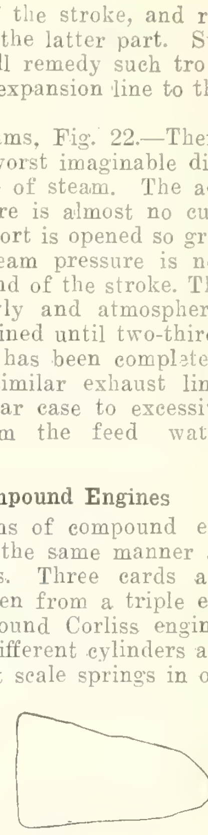


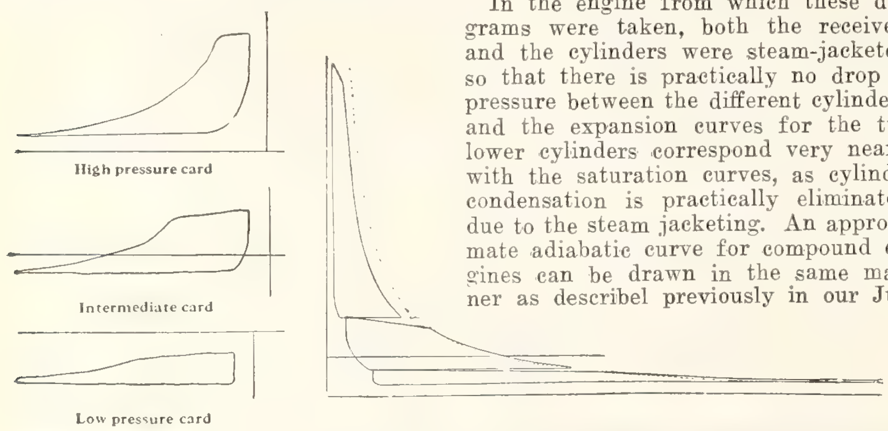
FIG. 23.

der that their areas may be large enough to show up well. From these cards it is seen that the high pressure cylinder is working entirely above atmospheric pressure. In the intermediate cylinder the pressures run both above and below while the low pressure cylinder works entirely below atmospheric pressure.

In order that these cards may appear in a proper relation, one to the other, they are usually combined on one large diagram. To do this, the pressures and volumes in the several cylinders have to be reduced to a common scale, and when so laid out the different cards fall in their relative positions, as seen in Fig. 25. In the combined card, the total length of each individually represents the volume of the corresponding cylinder in cubic feet. The cards shown on the combined diagram for each cylinder represent the average of several cards for both sides of the piston. In laying out the cards, the distance from the line of no volume represents the mean clearance volume for each side of the piston for each cylinder.

Combined Cards of Triple Expansion Engine

In order to get some idea of the distribution of the steam in the various cylinders, it is generally customary to draw on the combined card, saturation and adiabatic curves. One saturation curve cannot be drawn for three cylinders as the weight of the steam expanding in each is different, due to the different clearance volumes. The saturation curves are constructed by taking the values of the pressure and volume from Steam Tables of the weight of steam expanding in each cylinder. The weight of the steam in each case is the steam used by the engine per stroke, plus the weight of the steam entrapped in the clearance space. The steam used per stroke can only be accurately determined by tests. The weight of steam in the clearance is obtained by knowing the clearance volume in cubic feet and the pressure at the end of compression taken from the indicator card, from which the weight can be obtained from Steam Tables by finding the weight of a cubic foot at the given pressure; from this, in turn, the weight in the clearance volume is easily calculated. This should be done for each cylinder, and saturation curves drawn as indicated.



FIGS. 24 AND 25. INDIVIDUAL CYLINDER AND COMBINED DIAGRAMS OF TRIPLE EXPANSION ENGINE.

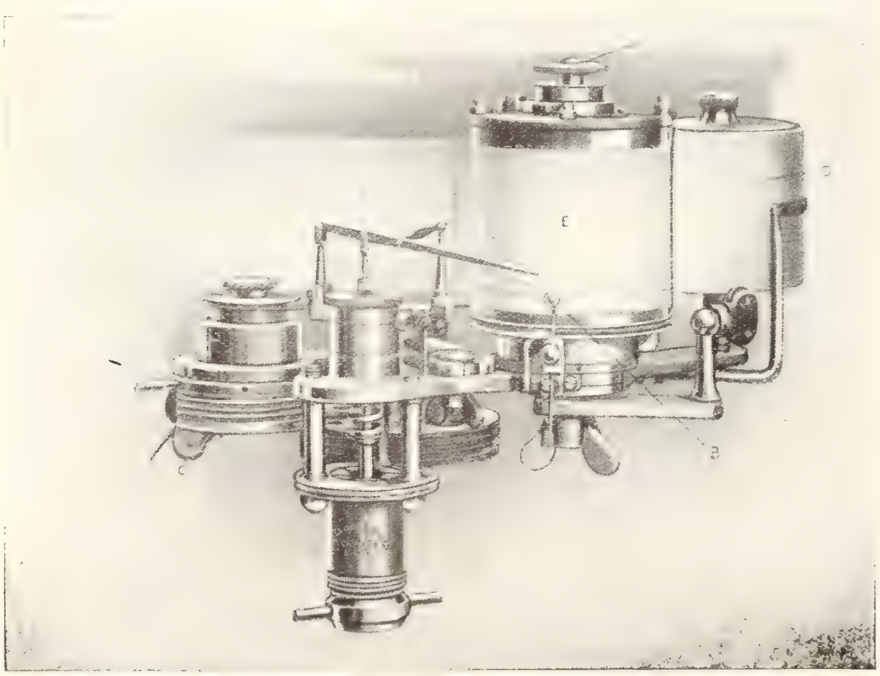
In the engine from which these diagrams were taken, both the receivers and the cylinders were steam-jacketed, so that there is practically no drop in pressure between the different cylinders, and the expansion curves for the two lower cylinders correspond very nearly with the saturation curves, as cylinder condensation is practically eliminated, due to the steam jacketing. An approximate adiabatic curve for compound engines can be drawn in the same manner as describel previously in our July issue. This will come slightly above the saturation curve.

By taking indicator cards from compound engines, following points can be determined. First, it can be ascertained if the lead is evenly distributed between different cylinders. Second, the adjustment of the valves can be effected the same as in a simple engine. Third, by the difference in pressure between the exhaust of one cylinder and the admission of the next one, it can be known if the receivers and piping are of proper proportions. An excessive drop between cylinders may indicate excessive condensation or that the piping is too small.

Compounding Advantages

One of the advantages incident to compounding steam engines is the equalization of the turning effort on the shaft. Thus, in a triple expansion engine having three cylinders, the three cranks are usually set at 120 degs. apart, and if an absolutely uniform turning moment is desired, it is necessary that the thrust given on each of these pins be equal. Most steam engines are so designed that this effect will be secured; however, frequently due to the valves not being properly set, it is found that one cylinder is doing much more work than the others and that the benefits due to using more than one cylinder are lost. Therefore one of the points to be ascertained in indicating compound engines is if the net work done in the different cylinders is equal. This can be approximated by theoretical methods if the initial pressure and dimensions of the cylinder are known, but it is much better to find it practically by means of an indicator. If the indicated horse-power from the separate cylinders of a compound engine are not equal, the valves should be adjusted until this is secured.

Equal work in the different cylinders is especially necessary when compound engines are direct connected to alternators which run in parallel. Here differences in angular velocity due to unbalanced work in the different cylinders will cause momentary changes in the voltage of the different generators and cause hunting. This spoils the regulation of the machines and cuts down their capacity.



"TRILL" TYPE CONTINUOUS INDICATOR WHICH GIVES AN INDICATOR CARD PER ENGINE STROKE.

MOTOR BOATS IN FISHING INDUSTRY.

ACCORDING to the latest statistics, there are 9,302 motor boats employed in the Canadian fishing industry, besides a number of motor vessels of the larger type. This is an increase of 600 motor boats in a year, and 3,400 in two years.

The boats are employed almost entirely in the Maritime Provinces and on the Pacific coast, where the greater number are engaged in the halibut fishery, the vessels employed ranging from small motor boats, carrying four to ten men, to large auxiliary schooners and steamers.

The introduction of the motor boat has revolutionized the fishing industry and largely increased the production. It has saved the fisherman time and rendered him independent of the wind. He can also make longer journeys off shore to the fishing grounds, thereby increasing his sphere of operations. One of the most important points is the increase in the catch, owing to the fact that the fishermen can get to the fishing grounds quicker, remain there a longer time, carry a greater load, and get back to port in less time than by the sail and oar method.

In the larger auxiliary schooners, the motor saves towage bills, enables the vessel to be manoeuvred in narrow channels, and brings her into the market quicker, with the fish fresher. There is less risk for the dory fishermen in squally weather on the Banks, as they can be picked up quicker.

CANADIAN MARINE "HEADLIGHTS"

ADAM B. MACKAY, capitalist, ship-owner, Mackay Building, Hamilton, was born at Hamilton, Ont., Jan. 15, 1866, son of Æneas Donald Mackay and Elizabeth (Hughes) Mackay.

After being educated at Wentworth School, Hamilton, and Trinity College School, Port Hope, he began his business career as a clerk with his father who was ship-owner, forwarder, wood and coal merchant in Hamilton. In 1894 he

ADAM B. MACKAY.

formed a partnership with his brother under the firm name of R. O. & A. B. Mackay, operating eleven different ship lines with head office in Hamilton; this business was incorporated in 1908 under the name Inland Navigation Co., Ltd., of which he was general manager; disposed of the business in 1910, and same is now merged with Canada Steamship Lines, Ltd.

Since the beginning of the war, Mr. Mackay has been actively engaged in reconstructing ships, one of which, the Turret Chief, was salvaged after the big storm of 1913, rebuilt and recently sold and delivered to Vickers, Ltd., of England. During the past six years, Mr. Mackay has reconstructed and disposed of nine large boats. In November, 1916, he completed a large schooner in Nova Scotia, and is operating three steamers on the Great Lakes. He is owner of 13,500 acres of farm lands in the vicinity of Kindersley and Regina, Sask.

Mr. Mackay married Letitia Hogg, daughter of Charles M. Hogg (late of the India Civil Service and now residing at Cheltenham, Eng.), Oct. 16, 1915.

He is a member of the National Club (Toronto); Illinois Athletic Club (Chicago); and is Presbyterian in religion.

His residence is Cheltenham, England.

—Photo, courtesy *British and Colonial Press.*

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Vol. VII AUGUST, 1917 No. 8

PRINCIPAL CONTENTS

THE U.S. STEEL EMBARGO

ADVICE to the Canadian Government of date August 8, by the Department of Commerce, Washington, states that an embargo on steel for shipbuilding purposes will become absolutely effective on August 15, and that, thereafter, all iron and steel products leaving the United States must do so under special license. While it is not believed that the restraint will militate harshly as regards our munitions requirements, nor too much so against those of our steel shipbuilding programme, there is little doubt but that Canadian consumers of steel for general manufacturing purposes will be more or less hard hit. Due to our steel mills having their capacity output under contract to the Imperial Munitions Board, consumer requirements for other than war needs have for many months been dependent on United States mills.

Whether the very material reduction that has taken place and is still operative relative to the number of plants engaged in the machining of shell will extend to the activities of our steel mills as well at an early date, is not at the moment clear. When account is taken, however, of the fact that the U.S. steel embargo is expressive of that country's determination to utilize her resources to the fullest possible extent in the production of munitions and other war material, and that the enormous expenditure of shell in recent weeks in France and Flanders only reduced Britain's supply of filled shell by some 7 per cent., it is not improbable that at a quite early date not only will our shell industry as regards its machining feature have practically disappeared, but the steel requirements for shipment either as such, or as forgings, may have shrunk to somewhat insignificant proportions. The great lack of "bottoms" to carry our steel and finished shell products across the ocean should, in addition, not be overlooked.

MANNING CANADIAN BUILT MERCHANT SHIPS

RELATIVE to the shipbuilding and marine engineering activity now in evidence within our borders, and which is almost certain to extend well into the next decade, there is, in spite of the generally widespread appreciation of the fact that the meantime situation and outlook are so promising, apparently little, if any, thought being given to the matter of personnel wherewith to operate the large number of ships which will be produced on this continent in the coming months and years.

That it requires time—years indeed—to produce a marine engineer who can be entrusted with sole charge of a modern ship's machinery is evidenced by the requirements of the British Board of Trade in granting certificates, while the curricula prescribed is certainly such that few ordinary machine shop mechanics could at the moment approach with any degree of success. The necessity for additions to the supply of available marine engineers, however, is more than obvious to those most directly interested, and the certainty of an insistent demand in the near future for men capable of developing rapidly into high grade and efficient operators, is such that steps might very well be taken now to afford opportunity for the acquirement of the necessary knowledge.

No one will suggest for a moment that because a farm hand, who looked after agricultural machinery and had a mechanical bent, could run a lathe and do simple munitions operations, therefrom he became *ipso facto* a machinist. However, many machinists, tired of shop routine and repetitive operations, may well see in marine engineering an occupation for which they could quickly fit themselves so far as present general requirements are concerned, and which, when normal conditions return, would offer them possibilities for advancement and continuity of employment for two or three decades.

Present participation no doubt is accompanied by risks, but the latter have been taken by many others for the benefit of those yet to come, and the fact that present conditions have been brought about by the acceptance of these risks should act as a stimulant towards emulation.

Marine News From Every Source

Victoria, B.C.—The auxiliary schooner Margaret Haney, Capt. Boyd, reached Bombay after an 86-day voyage

Toronto, Ont.—It is reported that the Thor Ironworks have been sold to the Standard Shipbuilding Co. of New York.

Victoria, B.C.—The fourth auxiliary schooner Malahat now being built for the Canada West Coast Navigation Co., will soon be ready for launching.

Basin, N.S.—The Chester Basin Shipbuilders, Ltd., has been incorporated and proposes to establish a shipbuilding plant at Basin.

Toronto, Ont.—A floating drydock has arrived here for the Toronto Dry Dock Co., who will operate a shipbuilding plant at Ashbridge's Bay.

Ottawa, Ont.—The House has passed votes aggregating $338,000 for bridges and harbor works in Ontario. This includes $96,000 for harbor improvements at Port Stanley.

Halifax, N.S.—The Tusket Shipbuilding Co. have purchased the saw mill of the Parker-Eakins Co., at Tusket Lakes, and are laying the foundation for a new mill at Milner's Lake.

The William Lyall Shipbuilding Co. has been incorporated at Ottawa with a capital of $1,000,000 to build ships of all kinds. The head office is at Montreal, and the incorporators are: E. Languedoc, R. E. Allan and W. Taylor, all of Montreal.

Vancouver, B.C.—There is a possibility of a galvanizing plant being established here in connection with the wooden shipbuilding industry. A plant is needed to galvanize such materials as boat spikes, drift bolts, etc., used in the construction of wooden ships.

Toronto Dry Dock Co. has been incorporated at Toronto with a capital of $100,000 to operate a dry dock and to build and repair ships of all kinds at Toronto. The provisional directors are John E. Russell, H. Cresswell and S. W. McKeown all of Toronto.

The British American Shipbuilding Co., has been incorporated at Ottawa by F. H. Keefer and A. L. Martin of Thorold, Ont., also A. A. Kinghorn of Toronto, to build and repair ships of all types with a capital of $1,000,000. The head office is at Toronto.

Vancouver, B.C.—The Wallace Shipyards, Ltd., on July 27, laid the keel of the second steel steamer, which will be a sister ship to the War Dog, which underwent her trials the previous day. The War Dog is back at the shipyard carrying out the final jobs before proceeding to sea.

Goderich, Ont.—Word has been received that an appropriation of $55,000 has been made for the harbor work needed at Goderich in connection with the establishment of the Goderich Shipbuilding Co. plant here. The work includes the construction of slips for launching into and dredging.

Vancouver, B.C.—A new concern, the Vancouver Shipyards & Engine Works, contemplate establishing a shipbuilding plant here. The company is said to be capitalized at $750,000, and has left contracts for the preliminary work which will consist of the building ways. S. Matheson is interested in the company.

Montreal, Que.—The Montreal Dry Dock Co. have practically rebuilt their plant on Mill Street. Since last year, when the dock had a capacity equal only to repairing scows and barges, extensive alterations have been made. The dock has been deepened, and machinery added to the equipment. The dock is 428 feet long and 30 feet deep.

Financial Aid for Drydocks.—The Dominion Government has decided to increase the subsidy for drydock undertakings by way of promoting them. A subsidy representing a percentage of the total outlay has heretofore been given. This percentage will be raised, because at present it is an insufficient encouragement to build docks.

Bids for Natironco Wreck.—Six bids have been received by the underwriters for the purchase of the wrecked Canadian steamer Natironco, which was sunk in collision in the Lower Detroit River several weeks ago. The bids ranged all the way from $25,000 to $32,000, the latter being by A. B. Mackay, of Hamilton, former owner of the vessel, who acted for French interests.

The North Shore Ironworks of North Vancouver are putting on the market a ship's winch similar to the type made by Clarke, Chapman & Co., Gateshead, England. The North Shore Ironworks are now under contract with the Imperial Munitions Board for sixty of these winches and eleven windlasses. They are also making winches for Coughlan & Sons, the Wallace Shipyards, and a concern at Portland, Ore.

St. John, N.B.—The Dominion Department of Marine and Fisheries has offer- to arrange for steamers of 2,000 or more tons' capacity to bring anthracite coal here for New Brunswick use, if dealers arrange to have the coal ready at an Atlantic port on certain dates. The question of finding facilities at St. John to handle coal steamers of that size without eating up the expense saved in transportation is now engaging attention.

Halifax, N.S.—News has been received here of the sinking of the Dominion Iron & Steel Co. steamer Heathcote in the Gulf of St. Lawrence on July 26. She was in collision with a Dutch steamer, which escaped with slight damage, and succeeded in rescuing the entire crew of the Heathcote. The Heathcote was loaded with limestone from Port-Au-Port to Sydney. She was of 2,345 tons gross, registered in Sydney, N.S., and was built in Sunderland in 1898.

St. John, N.B.—Tenders will be received until August 31, for the construction of an extension of and repairs to the Negro Point breakwater, St. John Harbour, St. John County, N.B. Plans and forms of contract can be seen and specifications and forms of tender obtained at the Department of Public Works, Ottawa, and at the offices of the District Engineers at St. John, N.B.; Halifax, N.S.; Shaughnessy Building, Montreal, P.Q., and Equity Building, Toronto, Ont.

G. T. P. Acquires New Steamship.—The Grand Trunk Pacific has added another ship to its North Pacific Coast fleet. This is the S.S. "Tillamock," which has been placed in service between Prince Rupert, the Western terminal of the G. T. P. line and Ketchikan, Alaska. This vessel is of United States registry, 119 feet in length, 29 feet beam, has a cargo capacity of about 450 tons, and good passenger accommodation. It will meet the growing demands of the Northern trade in handling fresh fish, in handling supplies to canneries, and in looking after general trade.

Would Welcome Lower Freight Rates—That Canadian manufacturers would certainly appreciate a reduction of ocean freight rates which is promised by the Shipping Commission represented by the Governments of Great Britain and the United States, was the opinion expressed by William Rutherford, president of the Montreal Branch of the Canadian Manufacturers' Association recently. The question of tonnage and high rates was a matter, he said, of considerable concern to the exporter, and the announcement that there would be a sweeping reduction in the latter would be espe-

cially acceptable in view of the fact that many goods could not be exported owing to the present prohibitive rates.

New Lighthouse Installations. — The Lake Carriers' Association of Detroit, Mich., has received notice from the Department of Marine and Fisheries of Canada, that a flashing white catoptric light at the west end of Long Point, on the neck, between the lake and inner bay, is still in operation and that its maintenance has not been discontinued. The Kincardine back range lighthouse, Lake Huron, has been painted white. Announcement is made by the United States Bureau of Lighthouses that light near the outer end of the west pier at Charlotte, Lake Ontario, is being changed from a fixed red to an occulting white light, of 4,000 candle-power, showing illumination of six seconds alternating with eclipse of four seconds.

Towing Steamer Launched.—A towing steamer was successfully launched from the shipyard of Robert Morrill, Collingwood, Ont., on Aug. 18. The vessel, which is constructed of white oak, will bear the name of Windsor, and is owned by the Ontario Gravel & Freighting Co., of which C. W. Cadwell of Windsor is president. Its dimensions are: Length, 105 feet; breadth, 23 feet, and depth, 12 feet. The motive power will consist of fore and aft compound engines, supplied with steam from a Scotch boiler, carrying a working pressure of 155 pounds to the square inch. It is expected that the steamer will be completed early in September, when it will be taken to the Detroit River to be used in towing sand scows and general freighting.

The British Corporation Registry of Glasgow, Scotland, at the instance of the Imperial Munitions Board, has established a branch in Toronto. Owing to the large number of hulls on the stocks in the various shipbuilding yards, the Imperial Munitions Board deemed it necessary that official surveyors should constantly be in touch with the work. For the past seven years Captain J. B. Foote, manager of the Marine Department of the Toronto Insurance and Vessel Agency, has had complete charge of the survey work in the matter of classing and supervising steel ships. Under the new arrangement Messrs. David Arnott and P. R. Court, naval architects and surveyors, who have arrived from Glasgow, Scotland, will be associated with Captain Foote in the work.

To Build Concrete Vessels.—A syndicate has been formed in Montreal and plans are about completed for the building of concrete steamships on the local water front. The Atlas Construction Co. of Montreal are the prime movers in this enterprise, and the members of the syndicate which will provide the initial working capital are well known business men of Montreal. Ships of this character have already been built in France and Italy, and are giving entire satisfaction. The first vessel of the kind to be constructed in Montreal will be 200 feet in length and the thickness of the hull will be from three to five inches. The cost of the vessel will be well within $100,000. The engines for this vessel have been contracted for, and it is expected that the vessel will be launched before October 1. It is stated these vessels can be turned out more rapidly than steel vessels and at much less cost. The first vessel is more or less of an experiment, but if it is successful an aggressive shipbuilding programme by several Canadian firms will be the result.

TRAFFIC THROUGH CANADIAN CANALS

J. L. PAYNE, comptroller of statistics, reports that the traffic through the canals of Canada in 1916 showed an increase of 8,384,688 tons. The total volume was 23,583,491 tons, though this tonnage includes duplication, which means that the same cargo quite frequently passes through two or three separate canal systems. After eliminating all duplication, the net tonnage is given as 21,011,905 tons. The distribution of gross traffic in tons was as follows: Sault Ste. Marie, 16,813,649; Welland, 2,544,964; St. Lawrence, 3,368,064; Chambly, 398,977; St. Peter's, 9,629; Murray, 46,680; Ottawa, 237,651; Rideau, 105,430; Trent, 45,000; St. Andrew's, 13,438.

The traffic as analyzed is as follows:

	Tons.
Agricultural products	5,178,806
Animal products	11,342
Manufactured products	834,266
Forest products	1,388,873
Mine products	16,170,204

The total volume of Canadian wheat moved through the canals of Canada and the United States at Sault Ste. Marie in 1916 was 185,003,667 bushels. Of this quantity, 82,807,342 bushels passed through the Canadian canal. Larger accommodation on the American side of the St. Mary's river probably accounts for the preference given that channel.

The growth since 1895 in the volume of Canadian wheat annually carried through the Canadian canal at Sault Ste. Marie is seen from these figures: 1895, 1,087,800 bushels; 1900, 5,573,267 bushels; 1910, 51,774,833 bushels; 1913, 101,066,133 bushels; 1916, 82,807,342 bushels.

Then comparison of 1915 and 1916 is as follows:—

Through the	1915 Bus.	1916 Bus.
Can. canal	48,727,911	82,807,342
Am. canal	121,389,950	102,196,325
Totals	170,117,861	185,003,667

Canadian wheat moved in the form of flour must also be brought into the account. The total quantity brought down in 1916 was 3,805,384 barrels, as compared with 2,215,098 barrels in 1915. At 4½ bushels to the barrel, this would represent 17,124,228 bushels of wheat.

The total volume of water-borne wheat in 1916 would thus be made up as follows:—

Through the Can. canal	82,807,342
Through the Am. canal	102,196,325
In the form of flour	17,124,228
Total	202,127,895

The distribution of Canadian wheat moved through the Canadian and American canals at Sault Ste. Marie from Port Arthur-Fort William in 1916 was as follows:—

To Montreal, 1,233,982 bushels; to Georgian Bay ports, 46,406,749 bushels; to other Canadian ports, 28,029,847 bushels; to Buffalo, 106,349,943 bushels; total, 182,020,521 bushels.

To account for all the Canadian wheat shipped eastward by water in 1916 there must be added the quantity passed through Duluth in bond. The complete statement would, therefore, be as follows:—

From Port Arthur-Fort William and Duluth, to Montreal, 1,686,482 bushels; to Georgian Bay ports, 48,007,361 bushels; to other Canadian ports, 28,029,847 bushels; to Buffalo, 107,279,977 bushels; total, 185,003,667 bushels.

FERRO-CONCRETE SHIPS

A GOOD deal has recently been written with regard to the building of ships with ferro-concrete. Unfortunately, the subject has been shrouded in much mystery, and no serious attempts have been made to make a careful comparison between ferro-concrete and steel vessels. The advocates of ferro-concrete construction, whether they believe it or not, try to make it appear that ferro-concrete is a better material for building ships than steel. It undoubtedly has advantages, but it is not reasonable to expect that a material like ferro-concrete which, weight for weight, is much less strong than steel can possibly produce a ship which will carry as much dead weight per ton of its weight as a steel vessel. On the other hand, ferro-concrete is clearly cheaper per ton weight than steel.

Ferro-Concrete Ship Cheaper

As a financial proposition, therefore, the building of ferro-concrete barges reduces itself to this: a certain weight of cargo has to be carried in a ship or a barge, or taking the more elementary consideration, say a barge. It has been very well established that the weight of the ferro-concrete ship will be greater than the steel ship required to carry the same weight of cargo. On the other hand, since ferro-concrete is a cheaper material than the steel, the ship constructed of the former might still be less expensive to build than the latter. Generally speaking, it may be said that the ferro-concrete ship will be cheaper. This then is a distinct point in favor of the new method of construction.

The Power Feature

There are, however, other things to be considered. Since the weight of cargo is the same in the two ships under comparison, and the weight of the new type

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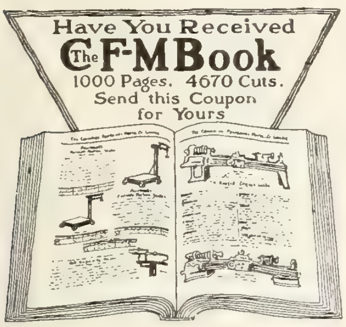
Rope Blocks	
Transmission Scales	Flare Lights
Small Tools	Etc., Etc.



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of ship is greater, the total displacement of the ferro-concrete ship will be more than that of the steel ship. In consequence, she will require more power to drive her, or if she is towed, more power to tow her. This, however, is not so serious as it at first sight might appear.

It may be taken that the ferro-concrete ship is two-thirds as heavy again as a steel ship. This increase of weight, however, is much less when expressed as a fraction of the total weight of ship and cargo, and generally speaking would only be about 15 to 20 per cent. In towage work this would not be a very serious matter. It would, of course, be of far more importance in self-propelled vessels, especially if high speed was necessary.

It is thought by some that a ferro-concrete vessel could be made to stand up to its work in a seaway. This, however, is purely a matter of design and is entirely decided by the amount of reinforcement that is put into the concrete. All kinds of structures have been built of reinforced concrete, which have to stand stresses and strains, such as bridges, girders, warehouse floors, etc., as well as large water tanks. There are, of course, special things to be thought of in a ferro-concrete ship which do not arise in connection with land structures. Here, again, these are matters of design, and can only be settled by a competent naval architect.

A Practical Proposition

It may be taken that the ferro-concrete ship is a perfectly practical proposition, and one more argument in its favor at the present time is that it will carry a much greater weight of cargo on a given amount of steel than will a steel ship. With the present shortage of steel, this is of first importance. Whether the ferro-concrete ship will continue to be used after the war is over, when it may be assumed that the supply of steel will be more plentiful, is a matter for some speculation, but there would seem to be no reason why it should not.

To sum up, the ferro-concrete vessel costs less to build, and requires much less steel per ton of deadweight carried, and in addition, its cost of upkeep is small.—Liverpool Journal of Commerce.

THE SUBMARINE LOSSES

BELOW will be found the official weekly returns issued by the Press Bureau and compiled by the Liverpool "Journal of Commerce," relating to the war losses of British merchant shipping, and the arrivals and sailings of merchant vessels of all nationalities (over 100 tons net), at and from United Kingdom ports. Fishing and local craft are excluded from the sailings and arrivals. This return invariably includes all mercantile tonnage known to have been sunk by mine or submarine either employed on Government service or otherwise:—

Week ending	All Nationalities Arrivals	All Nationalities Sailings	British Merchant Ships Sunk by Mine or Submarine 1,600 tons gross or over	British Merchant Ships Sunk by Mine or Submarine Under 1,600 tons gross	British Merchant Ships Unsuccessfully attacked	Fishing Vessels Sunk
Feb. 24	2,280	2,261	16	6	16	5
Mar. 4	2,528	2,477	15	8	15	2
" 11	1,985	1,959	12	4	12	3
" 18	2,528	2,554	18	8	20	21
" 25	2,314	2,433	20	7	12	18
April 1	2,281	2,399	17	14	20	3
" 8	2,406	2,367	17	2	13	7
" 15	2,379	2,331	19	9	13	11
" 22	2,585	2,621	41	15	27	10
" 29	2,716	2,690	39	12	27	7
May 6	2,374	2,499	19	22	30	15
" 13	2,568	2,552	17	5	15	3
" 20	2,664	2,759	19	9	12	3
" 27	2,719	2,768	18	2	22	2
June 3	2,693	2,642	15	3	15	5
" 10	2,767	2,822	24	10	20	6
" 17	2,897	2,993	25	5	37	..
" 24	2,876	2,923	21	6	19	..
July 1	2,745	2,846	15	5	13	12
" 8	2,898	2,798	14	3	13	6
" 15	2,828	2,920	15	4	15	8
" 22	2,791	2,791	19	3	12	1
" 29	2,747	2,776	18	3	*9	..

*Including three attacked during week ended July 22.

Italian Losses

The following are the figures of the movements of merchant vessels of all nationalities in Italian ports during the week ending Sunday, July 29:—

Arrivals	810	412,045
Departures	536	401,168

This is exclusive of fishing boats and coasting vessels.

Losses of Italian ships on all seas were:—Four sailing vessels, only one over 250 tons. One steamer was attacked and damaged, but was able to be saved.

CATALOGUES

Anti-Fouling Compositions.—The American Venexiani Paint Co., New York City, have issued a catalogue describing the "Lamoravia" anti-corrosive and anti-fouling compositions for ships bottoms. The merits of the various compositions and methods of application are dealt with while the various claims as to the durability and efficiency of these materials are also discussed at length.

Air Compressors. — Bulletin K-500-A, illustrating a line of power driven, single stage, straight line air compressers manufactured by the Canadian Ingersoll-Rand Co. of Montreal. These machines are designed for motor or belt drive and are furnished with a special short belt drive where floor space is a consideration. They are intended for use in industrial and mining plants where units of 950 cu. ft. displacement and under per minute are required. Eighteen sizes are built giving a wide range of choice.

Feed Water Treatment.—The Dearborn Chemical Co., of Canada ,Ltd., Toronto, are distributing a bulletin describing the Dearborn scientific treatmen of boiling feed waters. The bulletin gives a list of the substances commonly held in solution in feed waters and describes their action either in the formation of scale or corrosion of the boiler plates. The bulletin also deals with the Dearborn method and boiler preparations.

Electric Lamps.—Bulletin No. 78 describes the Cooper Hewitt electric lamps for photographic purposes. The bulletin gives full particulars and prices of the various outfits and different apparatus used in connection, accompanied by illustrations. The bulletin also contains suggestions as to the proper outfit to be used for various purposes in photography with illustrations showing studio arrangements. Copies of the bulletin may be obtained from The Cooper Hewitt Electric Co., Hoboken, N.J.

Steam Specialties—The V. D. Anderson Co., Cleveland, Ohio, have issued a new and well gotten up catalogue entitled "Anderson Steam Specialties," which include steam and air traps, steam and oil separators, water columns, pressure oil filters, copper floats, etc. The construction and operation of each product is fully described, accompanied by illustrations showing exterior and cross sectional views. Tables are also included giving the principal dimensions and other data for each size of trap or separator, etc. The catalogue also contains plates showing three arrangements of the Anderson oiling system.

Mechanical Rubber Goods, Valves.—Catalogue and price list No. 8 deals with an interesting line of valves, packings, and mechanical rubber goods manufactured by Jenkins Bros., Ltd., Montreal. This is a useful catalogue to have on file for reference, as it covers a full line of the above products and contains considerable descriptive matter about each in addition to the price lists. The catalogue is fully illustrated, while the concluding section No. 8. contains a price list of parts, tables of weights, and dimensions, together with diagrams, and also provincial registration numbers for the various types of valve. In this section is also included diagrams in connection with the dimension tables. The catalogue contains 252 pages, including a complete index and is bound in substantial cloth covers.

There is more than one way of getting an education. Preserving and reading catalogues is one way.

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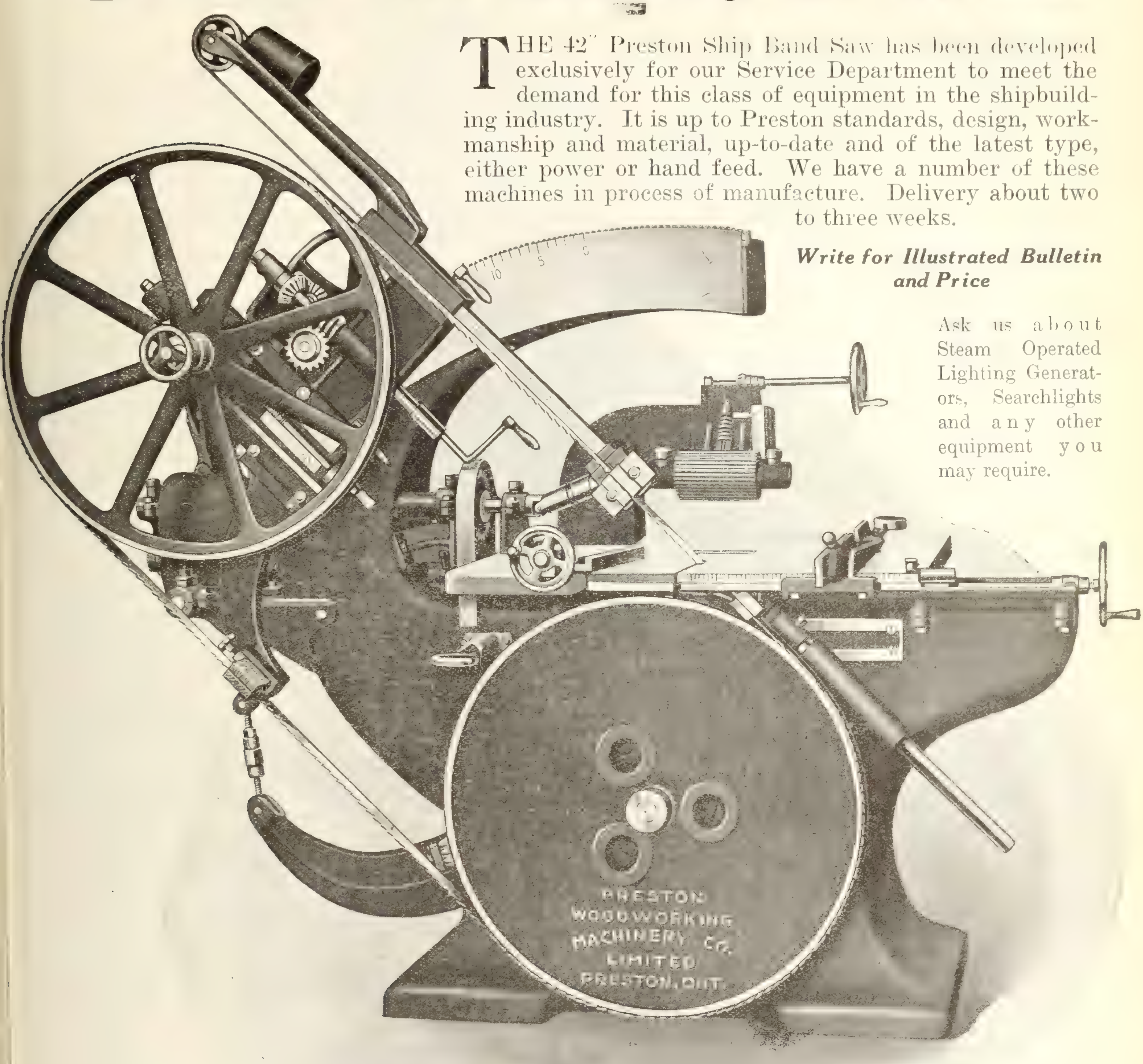

Service Department,

The A. R. Williams Machinery Co., Limited

TORONTO

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Robert Boyd, for thirty-three years keeper of the Five Mile Lighthouse in the St. Lawrence River, died at Brockville, Ont., on August 8.

W. G. Ross, president of the Montreal Harbor Commission, has been granted the special service decoration of the British Navy League as a recognition of his services to British sea power during this war period.

Captain Kay has been appointed as master of the steamer War Dog, the first steel ocean-going vessel to be built in Vancouver, B.C. Captain Kay has been in the employ of Chambers & Co. of Liverpool for many years and since war broke out has been doing transport work. The War Dog will shortly leave Vancouver on her first voyage.

Sarnia, Ont.—The steamer Bielman, out of service for years, has been rebuilt at the Reid drydock and will go into commission shortly. The boat is in good condition, although on the river bottom for years.

Three Rivers, Que. — Announcement was made on August 16 that a contract for the building of two wooden ships has been given to the Three Rivers Shipyard, Ltd., a newly formed local company. Anticipations are that further contracts will be obtained shortly. The company is advertising for carpenters, and work is expected to start at once.

Halifax, N.S.—The steamer Clematis, which went ashore on the Cape Breton coast last month, and through the efforts of A. McGregor, of the London Salvage Co., was pulled off the rocks and towed to Halifax for survey in the dry dock there, is to be repaired in that port. A New York concern tendered for the work, quoting a price of $210,000, but the Halifax Graving Dock was awarded the job on a tender of $164,000.

Steamship Action Entered.—The action of the Canada Shipping Co. of Montreal, against the steamship Celia, has been entered in the Admiralty Division of the Exchequer Court. The claim is for $7,500. It is alleged that the barge Katie H., belonging to the plaintiff company, was damaged in collision by the defendant steamer, below Sorel, on the St. Lawrence, at 5.30 a.m., August 3, and damaged to the amount claimed.

Brockville, Ont.—The steamer John Webster, built last winter by the Brockville-Morristown Ferry Co., and which since the opening of navigation has been plying between those two ports, has been sold to the United States Government at a price, it is stated, in the neighborhood of $40,000. On August 3 the boat was taken to Ogdensburg and arrangements for delivery were made there with a Government inspector. She is 106 feet long, 26 feet beam, and cost $25,000.

Taken Over by Britain.—Steel vessels now being built in Vancouver for J. E. Knudsen, representing large Norwegian shipbuilding interests close to the Norwegian Government, have been taken over by the British Government, according to notice received by the local construction firm. The Vancouver firm has a contract for something like eight boats. The first boat is now in frame and is also partially plated. It is expected she will be completed in the fall, the others to follow at intervals of three months. Originally contracts for five boats were let to the local firm by Knudsen.

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BOOK REVIEW

Jane's Fighting Ships, 1916, by the late Fred T. Jane, 449 pages, 12 x 7½ in. Published by Sampson Low, Marston & Co., London, England, price $5.25. This well known encyclopedia of the navies of the world is now in its nineteenth year of issue. This edition is new and complete, and has been sanctioned by the British Admiralty. In this edition the details of the British Navy have been reinstated, but without photographs and illustrations, and omitting, of course, any feature that might be of assistance to the enemy. The changes in this issue are suggestions of the late Mr. Jane, and have been carried out under the direction of Maurice Prendergast. A large number of new illustrations in the form of photographs, plans and silhouettes have been added, while many new maps of ports and harbors, brought into prominence by the war, have been included. Sections devoted to

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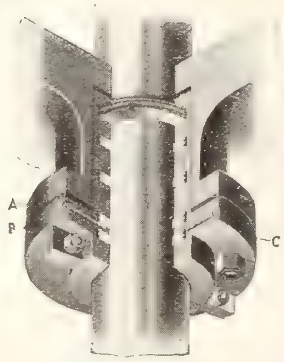
various navies have been enlarged and generally improved, while some very useful information has been included on German submarines. In spite of the restrictions imposed by the war, the book contains a great deal of valuable and interesting information. In regard to the British ships, although the illustrations and silhouettes have of necessity been omitted, particulars covering armament, machinery and general features are included. A list of illustrations of ships of all nationalities lost in the war is contained in the opening pages. The book has a list of contents and a general index, the latter being a list of ships of all navies. Additional to the 449 pages of reading matter are 161 pages of advertisements forming useful directory of shipbuilders and manufacturers. The book is printed on coated paper and bound in substantial cardboard covers.

War Ships, by Edward L. Attwood, M.I.B.A., 338 pages, 8¾ x 5½ in., 209 illustrations. Published by Longmans, Green & Co., London and New York. Price $4 net. This is the sixth edition of a book on the construction, protection, stability, turning, etc., of war vessels written primarily for naval officers, but it is also a work that will prove a useful introduction to the study of naval architecture for apprentices and students at naval dockyards. To achieve the purpose for which it was written the matter is necessarily technical, but at the same time is presented in a practical and comprehensive manner. The book contains twenty-three chapters and two appendices. Briefly, the chapters deal with the following subjects: The strength of ships, tests of steel, etc.; framing; beams, pillars and decks; plating, watertight doors and bulkheads; stems and sternposts, etc.; steering gears, pumping and drainage; ventilation, corrosion and fouling, armour protection, rules of mensuration, navy list displacement, buoyancy, initial stability, trim, stability at large angles of inclination, rolling and turning of ships, resistance and propulsion of ships, design of war ships. The last chapter contains notes on the loss of H.M.S. Victoria. Appendix A consists of a series of questions, which in many cases are intended to lead to inquiry and discussion, and cannot be directly answered from the text. Appendix B comprises the important 1906 British Admiralty memorandum concerning the design of H.M.S. Dreadnought. A number of blank pages have been inserted at the end of the book to provide space to note particulars and details peculiar to the ship on which the officer is serving, and to note changes of practice which may occur. The book covers the subject thoroughly and contains a fund of valuable information for naval officers. In the chaper on armour and deck protection reference is made to a number of war ships now in commission. The text is printed in clear type, and is illustrated by a large number of carefully drawn diagrams. The book has a copious index, and is bound in substantial cloth covers.



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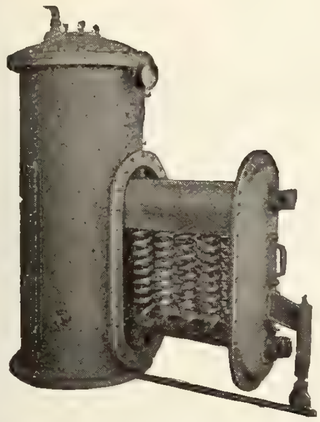

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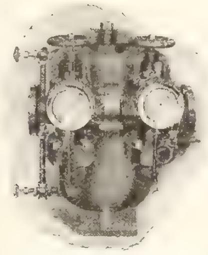

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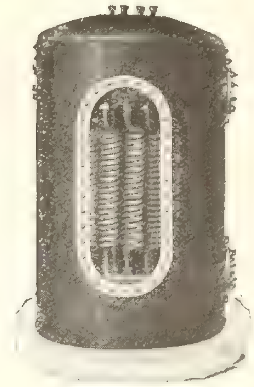

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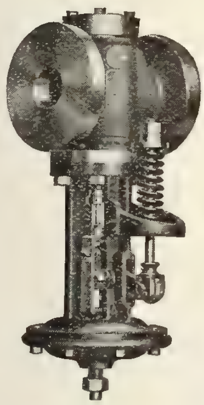

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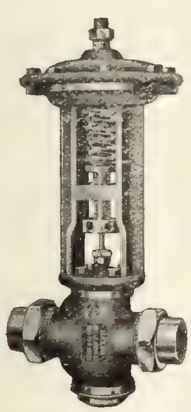

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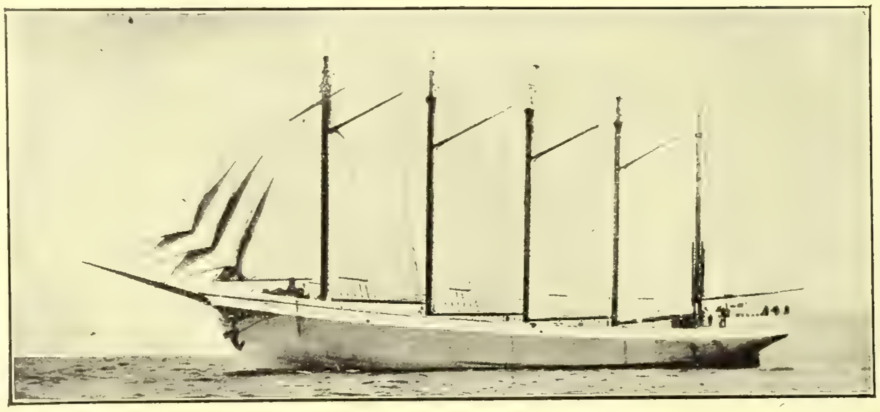

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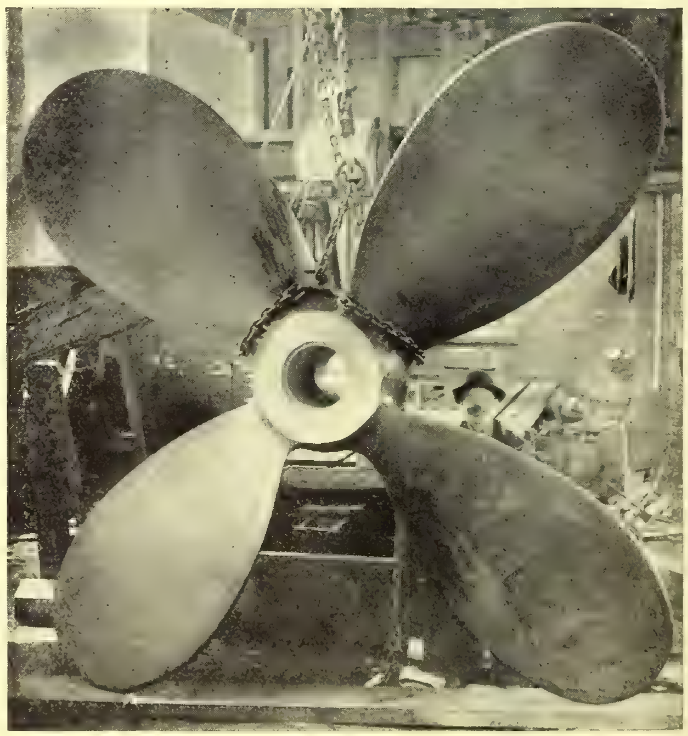

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Development of Ocean Service Shipbuilding in Canada--VII.

By C. T. R.

In addition to the widespread requisitioning of vessels for transportation purposes by the Allies, the war attendant and normal merchant ship losses and the many months' almost complete cessation of new construction on the part of the latter, the merchant marine of the world has had the misfortune to become to a large extent the target for enemy submarine activity. All nations have suffered in this respect, hence the almost feverish anxiety being displayed by shipping interests to have the losses made good at the earliest possible moment.

SHIPBUILDING on Canada's Great Lakes and on the St. Lawrence is particularly active at the present time in view of the approach of the close of navigation for another season, and the necessity there is that as many completed ships as possible reach the sea before our waterways become ice-bound. That the Port Arthur Shipbuilding Co. is making good headway in their deliveries is evidenced by the fact that the Ugelstad, launched on June 23, is now in the service of her owners, and the War Fish, launched on August 4, is scheduled to follow suit this month. Both vessels were originally ordered by Jas. Playfair, of Midland, Ont., but during construction other interests purchased them. Constructional, equipment, and machinery installation features are as follows:—

Features and Dimensions

The hull has the following principal dimensions:—Length over all, 261 ft.; length between perpendiculars, 251 ft.; breadth moulded, 43½ ft.; depth moulded, 28 ft. 2 in. It is of the single deck type, with poop bridge and forecastle, steel deck house on bridge, and deck and chart room on top of deck houses, with navigating bridge. The hull is built on the transverse system, with the propelling machinery amidships, and the coal bunkers in wings. There are two cargo holds, with two hatches to each, one hold extending from the collision bulkhead to the boiler room bulkhead, and the other from the engine room bulkhead to the after-peak bulkhead. A water bottom, 2 ft. 9 in. deep, extends from the collision bulkhead to the after-peak bulkhead. The construction is for the highest class of Lloyd's ocean service, and in accordance with the British Board of Trade requirements. The size of the machinery space has been arranged to approximate 13 per cent. of the gross tonnage, thus attaining a reduction of 32 per cent. from capacity tonnage.

The hull is built with flat plate keel and bilge keels, the latter, extending for about 100 ft. amidships, being of plate 9 in. deep, connected to the shell with angle bars fitted on short lengths, extending from butt to button shell, the plate being continuous. Each vessel has a straight stem and elliptic stern. Channel frames are fitted and extend from tank margin to main deck, and alternately to bridge deck, without hold stringers or 'tween deck beams. Plate floors are fitted on every third frame, except in engine and boiler space and forward of three-fifths length, which are 24 in. centres. The propeller frame is according to Lloyd's requirements, with rudder post extending to main deck, to which it is attached by angles and deep transom plates. The rudder is of the single plate type, with arms alternately on the port and starboard side. The hull is divided by four watertight bulkheads, and a watertight sliding door is fitted in the engine room bulkhead, to give access to the tunnel. There is a screen bulkhead between the boiler and engine rooms, with door and portable plate for drawing the condenser tubes.

The engine foundation is built up of plate and angles, with girders underneath, to line up with the fore and aft girders on the water bottom. The boiler foundations are of longitudinal plate girders, with large double angles on top edge and connected to tank top with double angles at bottom. The deck house on the bridge is of steel, 7 ft. high, of plating, 12.2, stiffened with 3x3x6.1 angles, as are also the engine and boiler castings. The flying bridge is built from the roof of the chart house to the ship's sides, and is 4 ft. wide, carried on angle iron framing supported on angle iron stanchions.

Auxiliary Equipment

A steam windlass 8 x 8 in., is fitted with hand attachment and friction brakes. The steam steering engine, 6 x 6 in., is placed in the after end of the engine casings, with the horizontal shaft protruding through the after side, with the bracket and chain drum on deck. Two 22 ft. lifeboats, and one 18 ft. working boat, are provided, together with life belts and life buoys as required by law. The bridge deck provides the captain's, first and second officers' quarters, which, with the accommodation for the crew, are complete with every modern convenience. The electrical installation includes one 7½ k.w. generator, with equipment for lighting the whole vessel, the sidelights being fitted for electric light as well as for oil.

Engine Data

The propelling machinery, also built by the Port Arthur Shipbuilding Co. consists of engines of the single screw, 3 cylinder, 3 crank type. with cylinders 20, 33½ and 55 in. diam. by 40 in. stroke, developing about 1,400 i.h.p. at 80 r.p.m. Steam is supplied by two boilers, each 14 ft. diam. by 12 ft. long, built for natural draught, at 185 lb. pressure. The boilers are equipped with corrugated furnaces, 42 in. inside diam., with separate combustion chamber for each furnace.

S.S. UGELSTAD ON THE WAYS READY FOR LAUNCHING.

OUR LATEST CRAFT—THE AUXILIARY SCHOONER

By Capt. Geo. S. Laing.

THE seas and oceans are now graced with a strange craft called the auxiliary schooner. Our Canadian and American shipyards are turning them out in considerable numbers. These vessels could be well termed half-breeds, in the sense that they have both the steamer and the windjammer embodied in their architecture. It is certainly something to be thankful for in these war days with its shortage of iron and steel products and dearth of ships to see this wooden vessel with her forest grown hull, and her internal combustion engines come among us.

For over a decade now we have been accustomed sighting the auxiliary schooner in the shape of fishing craft and a few coasters, but this article is concerned only with the up-to-date foreign trading auxiliary schooner which sets out for any part of the world, and has a carrying capacity similar to the great bulk of small steam tramps.

As one who has been employed both in sailing ships and steamers, the writer will attempt to show that the auxiliary schooner possesses many attractions and should have a bright future ahead of her.

Handiness in Port

In many harbors it is customary to make two or three shifts from one dock to another in the loading or discharging of a cargo. In the old style sailing ship this meant towage. In the ordinary tramp steamer it either means towage or getting up steam at a time when the steam engineer wants to see the inside of his boilers. With the auxiliary schooner, especially of the twin-screw type, this shifting around in port would be no trouble whatever. It only takes minutes in the motor engine room to start up, where it takes hours in a steam propelled ship.

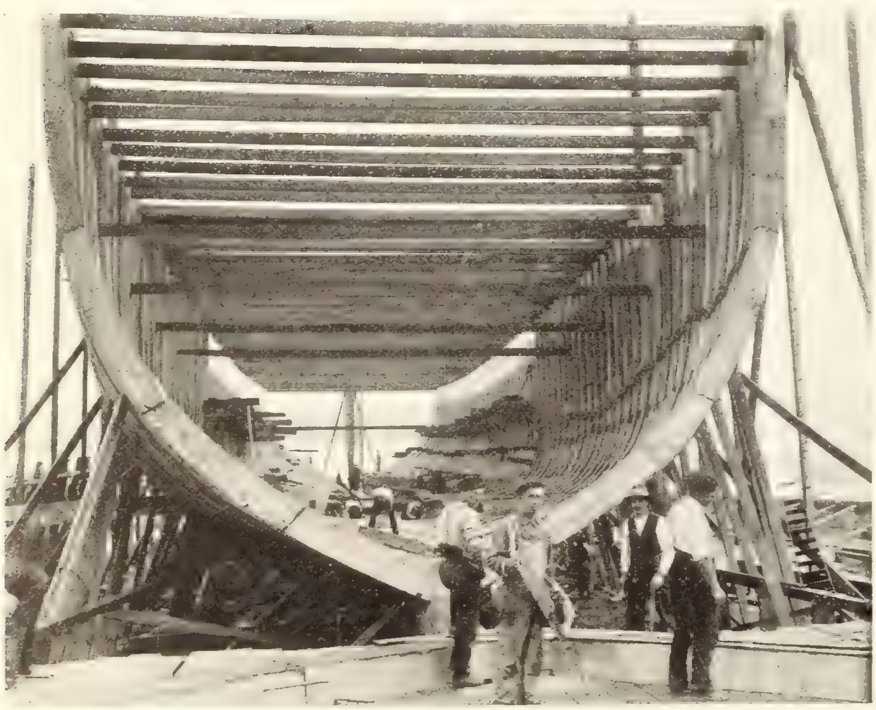
Dry Dock Troubles

With the ordinary tramp steamer or steel sailing-ship, the matter of a foul bottom is ever present and in both these craft a visit to the graving dock every year is essential. The reduction in speed caused by barnacles and grass growing on iron or steel vessels, runs as high as 40 per cent. after a year's absence from a dry dock. This is appalling, but it is true of all tropical traders, for it is in tropical or sub-tropical waters that the most of animal and vegetable life attaches itself to a ship's bottom—there to mature and flourish.

The auxiliary schooner protected with yellow metal may run afloat for two or three years without going into dry dock as far as a foul bottom is concerned. Dry dock dues are among the heaviest of the ship owners outlays.

On Ocean Routes

The auxiliary schooner has great advantage over the ordinary steamer by way of drawing power from the heavens, utilizing her white wings in favorable trade winds, monsoons, or the prevalent westerlies in the high latitudes of both hemispheres. During such times, the engineer will be able to throttle her a little and still make 10 to 12 miles an hour. Take for instance the run from Cape of Good Hope to Australia or New Zealand, and again from the Antipodes to Chili and Peru. On these routes the chances are that in many cases a vessel is simply chased with fair wind and following sea, if a proper course is taken according to the season.



WOOD SHIP CONSTRUCTION IN BRITISH COLUMBIA.

In Very Heavy Weather

The most helpless craft afloat in very heavy weather is the low-powered steam tramp. A few will shoulder the sea, but the majority of them flounder around in a radius of six or eight points and frequently do big damage while in this intoxicated state. The reasons for this bad behaviour are due mainly to lack of steam power to hold steerage way in the sea, the lack of canvas to aid the helm, in keeping their heads in one position, and the heavy rolling and diving motions that greatly reduce the work of a propeller, by keeping it too often in the air and too little in the water.

AUXILIARY POWER SCHOONER "MABEL BROWN." FIRST OF ITS TYPE BUILT IN CANADA.

An auxiliary schooner with her two-fold means of propulsion should be able to "heave to" and stay there with as much grace as a Grimsby smack or an Aberdeen trawler—two classes of craft that contribute to expert seamanship qualifications. A power schooner that is forced to "heave to," or "head reach" should be comfortable and reasonably quiet with a leg o'mutton spanker aft and a storm tri-sail forward, either on the inner bowsprit or foremast. Then with the starboard engine at half-speed for the port tack or the port engine at half-speed for the starboard tack, her movements should be that of a stately craft. Where this method works, one engine is stopped.

Her head should keep pretty steady at about 4½ points from the wind, thus taking the heavy sea on the bluff of the bow and at the same time making enough leeway to bring into play the valuable turbulent eddies from under her keel that help so much in staying the poundage waves on vessels "hove to."

To those who have not studied the wonderful effect of a ships "dead water"

eddies in a sea-way, just look astern at a ship's track in a moderate breeze and you will notice that a comparatively smooth streak holds out against the surrounding waves for quite a distance. The same thing happens when a vessel drifts bodily to leeward, leaving thus a broadside wake up to windward. The use of heavy oils on high seas is another eye-opener. This again is beautifully demonstrated by watching the calm streak that the engine-room bilge water discharge causes through its oily nature.

Towage Elimination

Coastal or river towage, which was so damaging to sailing ship earnings, disappears altogether with the auxiliary schooner. There is little doubt that she will also create a new class of seamen and officers. Again, as owners and builders have given more attention to the comforts of the A. B's. and apprentices than has previously been done, the manning of these vessels will proportionately become easier, for you can still invite decent folks to sea if you treat them right in matters of food and quarters, two main items that the old windjammer and a considerable number of steam tramps never knew the meaning of.

As regards the apprentice system which is one of the finest points about the schooners, these youngsters will soon spread the sea fever amongst the boys of their acquaintance, and so the ball will begin to roll for a growing fleet of Canadian manned merchant ships—the foremost national asset of any country lucky enough to have a seaboard.

Compass Installation

From a navigational point of view, the new schooners ought to be good vessels for compass work. A liquid compass is undoubtedly the best for steering purposes but a dry card is the most efficient instrument for a standard or navigating compass. Here too, is a chance for our old friend—the pole compass—coming back to life on these wooden lowermast schooners. The wily deviation that haunts the compasses of iron and steel ships should be very much modified on our forest product which claims no magnetic attraction either in hull or superstructure. Of course to be absolutely non-magnetic, these vessels would require to be made entirely of wood with brass or copper fastenings. Small compass errors mean less risk of making fatal mistakes in course plotting and cross bearing work on the chart, especially in reef-strewn waters or foggy weather near a coast.

Regarding Breakdowns

The auxiliary schooner has one of her finest qualities ever ready, that of changing her status from a power craft, to a sailing ship or vice versa, and it would indeed be a most un-usual disaster that could deprive her of both her engines and sails. There is a point however that could be more assured in this connection. The sail area on the vessels having "bald" or "stump" lower masts might be enlarged to enhance the speed where fuel shortage or more unfortunate happenings came along.

The writer's suggestion is to fit these craft with lower-mast caps and trestletrees which could be called on to support jury top-masts in time of dire necessity. The ship could spread three, four, or five gaff top-sails which would often mean fifty miles a day on her speed.

Take a five master with a fore, main, mizzen, jigger and aftermast, even if the above plan was only adopted on the main, mizzen and jiggermast, it wouldn't be a bad investment. With hollow steel spars, a telescope arrangement would be the most popular plan of "housing" the jury masts that would play a part in the augmentation of sail area. On the other hand the schooner captains may be glad to carry spare masts on deck to lash alongside the two or three hatches that are in the waist of the vessel, and practically under water in gales. Spars lashed alongside of exposed hatches act as breakwaters and take the sledge-hammer knock out of the waves that might otherwise stave in a midship hatch.

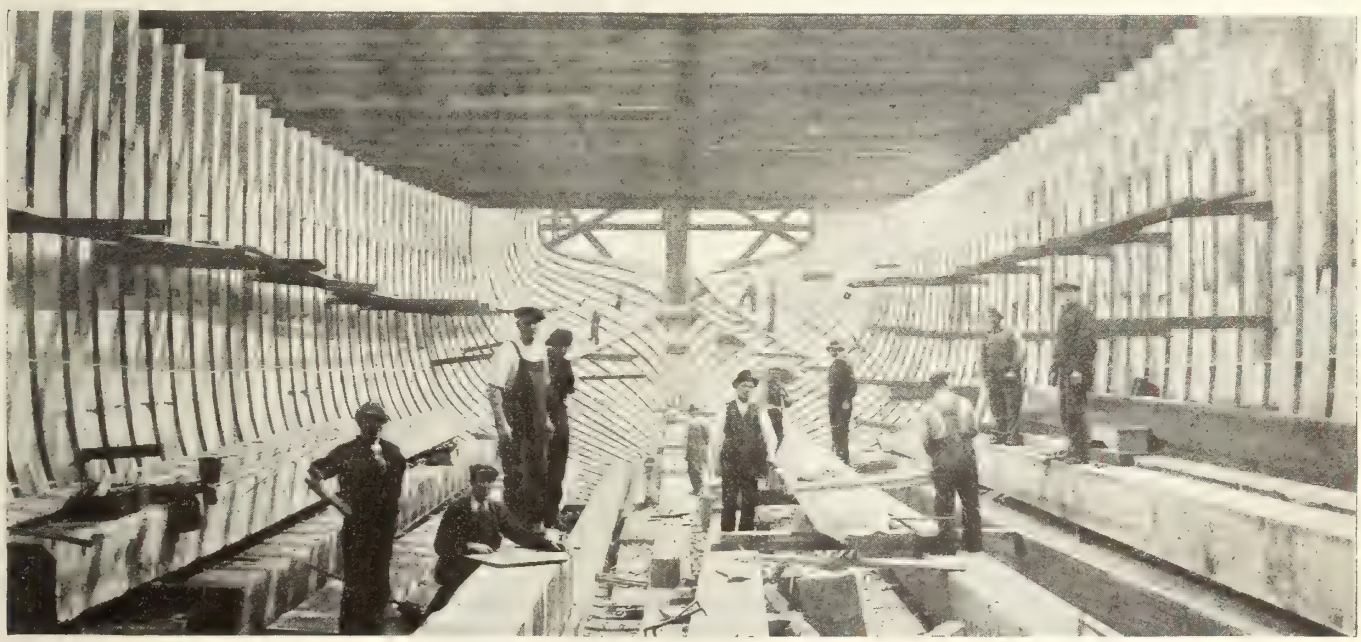
The Mabel Brown has a yard forward for use in "running," and although this class of foresail has to be lowered—owing to its peculiar gear—long before a square-rigger's foresail would be put in the gaskets, the sail is a very useful one where moderate winds are concerned. Again, this fore yard makes a nice boat boom in anchorages, and is also handy for guys and tackles that may be in use at that end of the ship.

Choice of Rig

As regards the choice of fore and aft rig for these interesting vessels, it might have been worth a trial to rig a few out as barquentines, with double top-gallant sails the highest canvas on the foremast. The other masts would then stand larger spacing, a three masted barquentine taking the place of a four masted schooner. Even with less engine power the barquentine might prove the better vessel for long voyages.

Rigs and Nations

The Russians and Americans have alwas taken to the all fore and aft rig in canvas, whilst the Norwegians, Italians and Nova Scotians have favored the three masted barque. There was a saying in sailor circles that no matter what foreign port one entered, there was sure to be found one or all of the following four things:—A British tramp steamer, a Norwegian barque, Swedish matches, and German musical instruments.



INTERIOR OF HULL UNDER CONSTRUCTION, AUXILIARY POWER SCHOONER "MARGARET HANEY."

Good luck to the Canadian auxiliary schooner, may she break into the same category of popularity and usefulness. Her earning power and record for time on passages must not be too severely criticized at first, for the craft are in their experimental stage, and the men who engineer and sail and navigate them cannot be experts at the dual game in an instant. The captains of these schooners will act very differently on their initial long distance trips in accordance with the experience they have had on other vessels.

Take a windjammer man for instance. If the schooner is bowling along under the dual system and the wind is inclined to lift the weather leaches, it is probable that this captain will let his vessel off a point, whereas a cast iron steam raised captain will furl everything in the shape of canvas, even to the engine room wind-sail, and let her plug into the sea under screw power only.

In the end, who will make the smartest runs in these vessels, the man who has had to rely on wind only, or the man whose chart room is generally above a coal bunker? It is natural to assume that the master who has both sailing ship and tramp steamer experience will do the best. With the apprentice system a new breed of seamen and navigators will grow up with the auxiliary schooners.

Friction Elimination

The freeing clutch that allows the propellers to revolve when under sail only, is a grand device, as some trouble may be experienced in finding real helmsmen for these schooners—men who can steer anything and who understand the principles of steering. With the screws going round in their out-board motions, the vessel is more easily balanced with the rudder, and dead water under the counter causes less friction when the propelling screws are turning over.

It is to be hoped that in the official log of the new schooners such entries as this may be found under remarks:

"Strong wind with quarterly sea, all sails drawing. Hove hand log in several squalls and found vessel making fourteen miles an hour."

"Passed a tramp steamer, going the same way, in the second dogwatch. Vessel behaving well. Gripping to windward easily controlled by careful steering. Shipping very little dangerous water, hatches in the waist under special observation after dark."

AUXILIARY POWER SCHOONER "MARGARET HANEY" READY FOR SEA.

MARINE DIESEL ENGINE PROBLEMS

THAT some departure of a radical nature in type or arrangement of marine diesel engines is necessary if maximum powers are to be profitably increased above the present figures is the opinion of a writer in The Engineer.

Success is one of those human qualities to which it is rarely possible to assign an absolute value, and in engineering progress one might almost say that there are no such things as failure and success, but only stepping stones. When, therefore, we speak of the relative failure of the marine Diesel engine, it will be understood that the phrase "relative success" would be almost as appropriate. We have to look at the matter from the point of view of how much was expected from the Diesel type in the past; how few, comparatively speaking, of those expectations have been realized, and try and imagine what progress is to be expected in the future.

We can recall the time when the Diesel engine first came to be talked about; when it was anticipated by some that its progress would be so rapid as to leave no room for any other type. And truly, if the overwhelming superiority in fuel economy had not been attended by corresponding disadvantages, there was no reason why these high expectations should not have been realized. It took about a decade for the land type Diesel to get through the period of its infantile troubles, and this type naturally had to be perfected before attention could be turned to the marine type. We do not propose now to enter upon the history of the marine Diesel engine—the various "stepping stones" in the development of the type have been from time to time described and illustrated in our pages—but rapidly casting our mind's eye over the experience gained in the last ten years, we are forced to the conclusion that the progress has been in the direction of perfection of detail and increase of reliability, rather than in any big advance in the sphere of its application.

Two Types Only

Broadly speaking, the marine Diesel is limited to two types—the high speed, which has its main application in submarines, and the low speed, which has been successfully applied to the ocean tramp. Of the former type it would be inadvisable to speak at length, but the limitations of the size of the high-speed Diesel were pointed out in a paper read by Lieut.-Commander Anstey at the Institution of Naval Architects eight years ago, and experience since has confirmed the conclusions arrived at in that paper. Speed of revolution, on which low weight per horsepower mainly depends, cannot be maintained as the size of the cylinder is increased, with the result that bigger powered units must be heavier, or else the increase of power must be obtained by the multiplication of cylinders.

In the type which has been developed for the tramp, weight is not a primary consideration, and here the limiting condition has been the size of cylinder. We have heard of experiments being made with very large cylinders of the order of 1,000 horsepower, but so far the results have been maintained in reserve. We are not handling an ordinary engineering problem when we come to deal with Diesel engine cylinders of, say, 50-inch diameter, which may be exposed to a pressure of anything up to 900 pounds or 1,000 pounds per square inch.

$20,000,000 Corporation.—A twenty million dollar corporation to operate ships between San Francisco and the Orient, has been formed by seven Japanese, who have amassed fortunes in the shipping boom in the Far East, according to Teiji Ishida, president of the concern, who was in San Francisco to-day to establish an American office.

One of the directors of the concern, said Ishida, is Chozo Ito, who five years ago was a mechanic in a Tokio shipbuilding yard, and is now considered the richest man in Japan.

It is planned to make Manila a port of call to relieve the shipping conditions there, where it was said millions of dollars worth of hemp, copra, rice and other commodities are piled on the docks waiting shipment.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

PORTABLE CRUDE-OIL FURNACE.

By J. Ralph

IN the erection of structural steel works, such as bridges, buildings, ships, etc., is it necessary that some convenient means be provided for the heating of rivets, dressing of tools or similar work, requiring the use of a small furnace, therefore, one that can be easily transferred to different positions, as the work progresses, proves the most efficient. Where the air for combustion is supplied from a central blower or compressor, the supply pipes and flexible hose often entail considerable expense for installation, and sometimes occasion injury to the workmen from their straggling position about the structure. The accompanying cuts illustrate a small crude-oil furnace designed by a structural steel worker, the operation of which has given very good satisfaction. The device is self-contained and can be placed upon the flooring or be readily applied to suitable members of the structure. It is hand operated but so designed that the minimum amount of labor is required in its manipulation.

The sketch Fig. 1 shows a front view of the furnace, while Fig. 2 shows a sectional view of the fan and gearing.

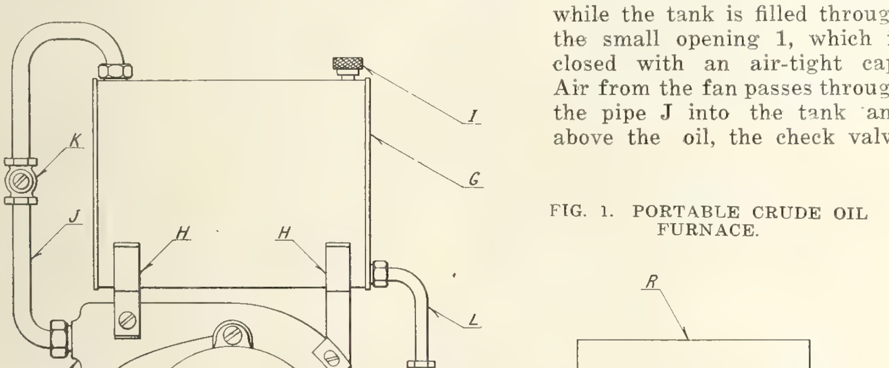


FIG. 1. PORTABLE CRUDE OIL FURNACE.

As illustrated in the former figure, the base A, made of angle iron, is supported on a central casting B which carries the four legs; the latter of a suitable length to raise the fire chamber to the desired height for convenient operation. The gear casing C, which is bolted to the fan casing, is attached to the frame by the small brackets (d). The fan casing is provided with two openings E and F, the air from the former supplying pressure

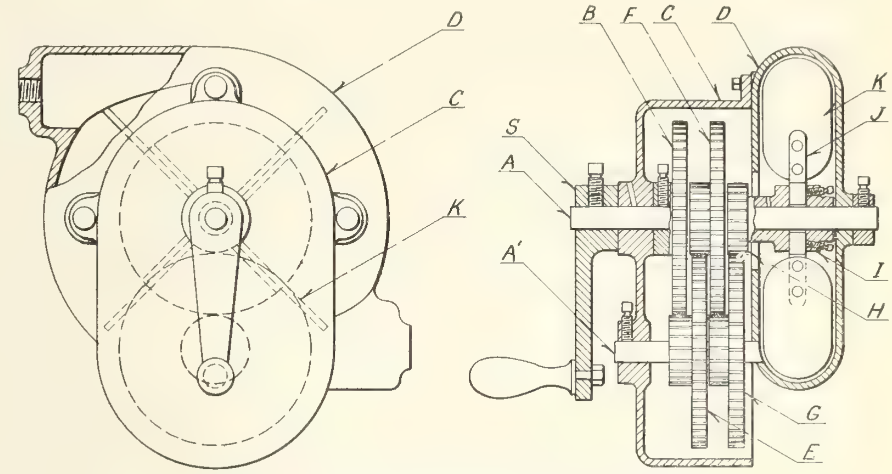


FIG. 2. PORTABLE CRUDE OIL FURNACE.

to feed the oil from the tank, and the lower outlet F feeding directly through the burner to the fire chamber. The oil tank G is supported above the fan by the brackets H secured to the fan casing; while the tank is filled through the small opening 1, which is closed with an air-tight cap. Air from the fan passes through the pipe J into the tank and above the oil, the check valve K preventing the return of the air when the fan is shut off. The oil is fed down through the pipe L to the burner M, the flow being regulated by the small pet cock N; this pet cock can be so adjusted that a pilot light will be maintained when the operator requires to leave the furnace, the oil under pressure being gradually forced to the burner. The intensity of the flame can be accurately regulated by the hand wheel O, cutting off or increasing the volume of air. The mixture passes through the opening P into the fire chamber Q, the opening to which can be covered by dropping the door R.

The sectional view of the fan and gear train gives an idea as to how the speed ratio of the fan blades is obtained. Secured to the main shaft A, which is operated by the crank handle S, is the first driving gear B which meshes with the pinion on the compound couple E, the gear on the latter meshing with the pinion of the couple F, which in turn transmits the power to G and thence to the pinion H, this pinion being integral with the hub I carrying the pins J, to which are riveted the blades K. The hub I which supports the fan blades is loose on the shaft A and revolves in the same direction as the operating handle S, but at a speed in relation to the ratio of the final to the primary movement of the gear train. In this instance where the ratio of the gear to the pinion is 3 to 1, the speed of the fan will be 81 revolutions to every turn of the handle S.

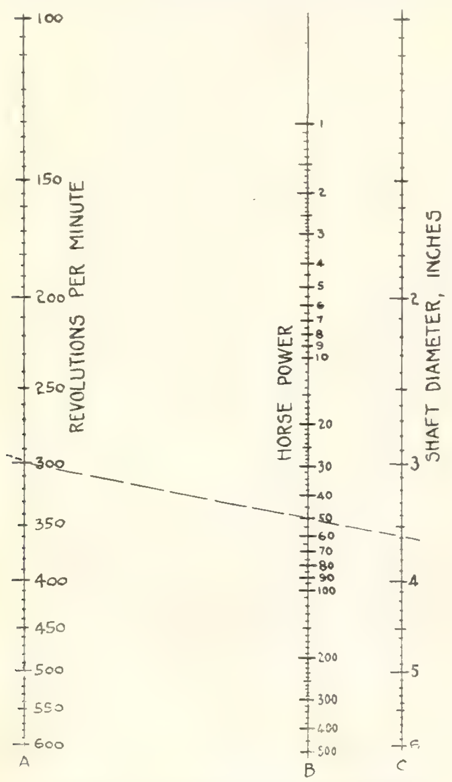
SHAFT DIAMETERS OF HIGH SPEED ENGINES.

By N. G. Near.

A RATHER peculiar thing about steam engines is the varying designs and sizes adopted by the different manufacturers. One manufacturer will use a 3½ inch shaft for a 50 h.p. engine running 300 r.p.m., whereas another manufacturer will use a 4 inch shaft at the same speed. There is no good reason why there should be this difference in size, aside from the fact that one might prefer to use a greater

factor of safety than the other. Since the cost of an engine is proportional to the weight, it is evident that the engine having the larger shaft is liable to weigh more than the engine having the lighter shaft and as a result the maker of the light engine can undersell the maker of the other. Inasmuch as both these engines give good dependable service when in actual use, however, it is difficult to tell which engine is "best." Perhaps the heavier engine will last longer, and perhaps not, in spite of its higher cost.

O. N. Trooien of the University of Wisconsin has studied steam engine design pretty thoroughly and has tabulated most of the common dimensions used in current steam engine design. Based on these tabulations he has developed curves or formulas which represent the average practice. It is allowable for us to use curves and formulas of this kind



HIGH-SPEED ENGINE SHAFT DIAMETER CHART.

because we can rest assured that they will "work." They will give us engines and parts of engines that will be heavier than the lightest, and lighter than the heaviest. Mr. Trooien's study covered the best known engines only—not those that give trouble or are doomed to failure. As a result of this investigation, an "average" formula was developed for the shaft diameter of high speed centre crank engines. This is the formula:

$$d = 6.6 \sqrt[3]{(h.p. \div N)}$$

where d = diameter of the shaft in in.
h.p = the horse power of the engine
N = the revolutions per min. on the shaft.

Based on this formula, I have developed the chart herewith which will be found handy for determining any shaft diameter for any ordinary high speed engine. All that is necessary is to lay a straight-edge across as indicated by the dotted line drawn across the chart and the intersection with the "unknown column" gives the desired result. For example: What should be the diameter of a shaft for a 50 h.p. engine whose speed is 300 r.p.m.?

Connect the 300 (column A), with the 50 (column B), and continue the line until it cuts column C. The intersection with column C shows that the shaft diameter should be 3.6 inches. Should it be desired to make the diameter larger, of course, that could be done, at the same time, it would not be good policy to make the diameter smaller.

The chart will also be found useful for determining the safe load that can be imposed on your engine. Let us suppose, for instance, that the shaft in your engine is larger than necessary for carrying normal load, and this you can easily find out by using this chart. Thus if your shaft diameter is 3.6 inches, whereas it should be only 3 inches according to this chart, it is evident that little danger will result from increasing the pressure on the piston as far as the shaft itself is concerned. To be sure the other parts of the engine must be considered also before increasing the pressure or endeavoring to make a high-powered engine of it. One must be careful of the piston rod, the keys, the cylinder walls themselves, the head and crank end of the cylinder, etc. Every part that will be subjected to a greater stress must be given a proper examination and reckoning.

The range of this chart, it will be noted, is wide enough to care for almost any high speed engine, delivering all the way from 1 to 500 h.p. and covering all speeds from 100 to 600 r.p.m. It is very seldom that we see an engine with a shaft smaller than 1 inch or larger than 6 inches, and that is why, altogether, the chart can be considered complete and should be handy to keep on tap by engineers, students, designers, etc.

TESTS FOR OILS AND VARNISHES

By C. T.

ONE of the most reliable tests for raw and boiled oils is the flash test, the temperature at which linseed oils usually flash being 470 deg. Fahr., whilst mineral oil, which is the chief adulterant of linseed oil flashes at about 400 deg. F., and resin oil still lower, so that the flash test is a simple method of detecting adulterants.

If the amount of the adulterant in the oil is to ascertained weigh a portion and place it in a beaker or any suitable vessel, and add a small quantity of caustic soda, alcohol, and a little water. The contents of the vessel should be then boiled for some time, with constant stirring, after which the oil will be found to be saponified, whilst the adulterants will be unchanged. The mass is then poured into a separating vessel, and agitated with benzine until it takes up the mineral oil, which afterwards comes to the surface of the vessel. The bottom layer is then run off and the top portion is well washed with warm water until all traces of the saponified oil have disappeared. The residue, which is mineral oil, is placed in a vessel and weighed.

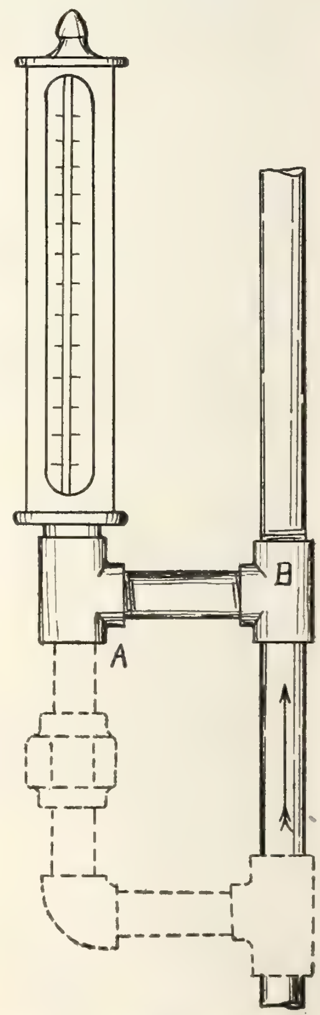
Common resin is also used as an adulterant, and may be easily detected, if in any considerable quantities, by painting some of the oil on any glass surface, and when, it is thoroughly dry, rubbing well with the finger. If the oil contains much resin the film will leave the glass and crumble, whilst a good oil will not be affected.

The only reliable test for turpentine is distillation. The chief adulterants are shale spirits, Russian turpentine, resin spirit and coal-tar naphtha. The determination of the proportion of the adulterant would require special chemical apparatus, but a simple method is to warm a sample of the suspected turpentine and a sample of pure American turpentine. Should the suspected turpentine contain any of the above adulterants they may be easily detected by the odor, which is entirely different from the pure American turpentine.

MAKING THERMOMETER REGISTER CORRECTLY

By K. Noble.

A THERMOMETER connected on a hot water pipe did not register correctly. It



MAKING THERMOMETER REGISTER CORRECTLY.

was connected as shown in sketch, a plug being in the end of the tee at A.

The plug was removed and a pipe connected as shown by the dotted lines and everything was O.K. The flow of the hot water is shown by the arrows. Of course an angle end thermometer could have been secured and connected into tee B. However this would have partly obstructed the upright, but even to buy another thermometer.

FLOW OF STEAM THROUGH A GIVEN ORIFICE.

By N. G. Near.

NAPIER'S formula is well known the world over in engineering circles as a "pretty good one" for determining the flow of steam through an opening into the atmosphere. It may be applied nicely to finding the weight of steam used by a steam jet blower such as is often used for inducing draft in the chimney or for forcing air through the grates directly. In other words, where the drop in pressure is great, Napier's rule is excellent.

I have often related my experience with Napier's formula, which is sometimes doubted; but it is absolute truth. I measured the diameter of an orifice to to the hundredth of an inch by simply applying this rule, and I had never so much as seen the orifice until after my computations were all made. I weighed the water condensation from the steam that passed through the orifice and then dermined the diameter of the orifice "backwards". The diameter was 0.16 of an inch. This is the formula

$$W = \frac{P\ A}{70},$$ where W=the weight of steam passing through the orifice per second in pounds.

P=the absolute steam pressure in pounds per square inch.

A=the area of the orifice in square inches.

It is therefore evident that it wasn't much of a trick to use the formula backwards after knowing P and W.

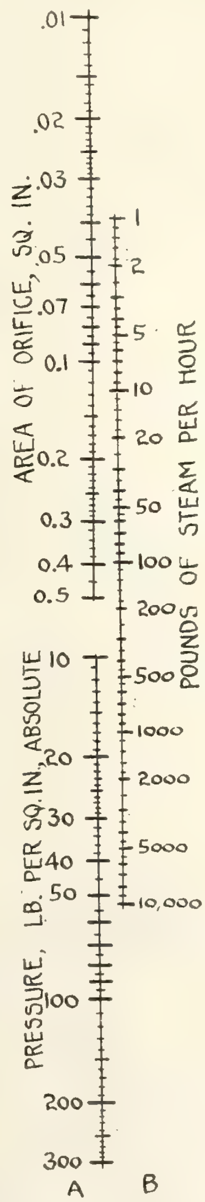
This little chart is based on that formula. It gives the weight of steam flowing through the orifice per hour instead of per second (see column B.).

To show how the chart is used let us take an example:—"Where the area of the orifice is .07 sq. in. and the steam pressure is 100 lb. per sq. in., how many pounds of steam flow through per hour?

Find the .07 in column A and the 100, also in column A. Then find the point midway these two figures. Directly opposite the mid-point is the answer, 360 pounds per hour.

It is a simple matter to find the mid-point. If you have a slip of paper handy just lay it alongside the scale and double it between the two points. Get the idea? The mid-point is at the crease, exactly. You can't beat the method with the finest pair of proportional dividers made. Of course, if you have a pair of dividers handy, use them, or use a ruler. There are many ways in which a line can be bisected but some of them are easier than others. What we all want, always, is the easiest way.

Again, should it be desired to find the area of orifice necessary to carry away 360 pounds of steam per hour with a steam pressure of 100 lb. per sq. in., you would go at it in the "opposite" manner. Find the distance from the 100 (column A) to the 360 (column B), and then measure upward that self-same distance from the 360. The answer, of course, is .07 sq. inches, pound in column A.



FLOW OF STEAM THROUGH A GIVEN ORIFICE.

Another application of this rule or chart is to the soot blower. It will tell at a glance the weight of steam used per hour in blowing soot. From the result one can easily compute the cost of steam for soot blowing. That is a subject that has scarcely been discussed, if at all. Have you ever thought of it? Why not use the chart or formula once in a while, here and there, and determine a few of your costs? Maybe they are more than you have estimated off-hand and maybe they are less.

Further, maybe you have a lot of leaky pipes in the plant. Maybe you have some cracked valves here and there which are purposely cracked to carry away the condensed steam. Maybe you feel that cracked valves are cheaper than a good steam trap. There are hundreds of ways, almost, which this chart can be used in and around a steam plant. Steam is expensive these days. It is growing more expensive right along. It should therefore be studied a bit more carefully. No harm can result from knowing the aproximate cost of every little operation where steam is used.

TURBINE SPEEDS AND APPLICATIONS

By T. J.

IN the earlier stages of its development the steam turbine was considered in many quarters to hold great possibilities, not so much from high epxectations of thermal efficiency, as by reason of an assumption that it must prove an ideal prime mover for coupling to electric generators in power stations and propeller shafts in steamships. But mechanical arrangements seldom work out in practice along the line of the ideally simple and direct; and the speed of the large turbine units now in use has proved to be too high to permit of the satisfactory direct coupling of turbines either to propeller shafts or to generators.

Turbine speeds can, of course, be reduced by increasing the size of the motor, but only at the price of greater weight, higher initial cost and reduced efficiency; and consequently the present trend in both electrical and marine engineering is all in the direction of introducing some form of reduction gear between the turbine and the propeller shaft or generator.

The difficulty confronting the marine engineer is that the most efficient speed for a screw propeller is only about a quarter or a fifth of the most efficient speed of a steam turbine, and if he decides upon reduction gear his choice is between helical gearing, electric reduction drive and hydraulic reduction drive. The power station engineer is up against the fact that a direct-current generator running at 2,500 or 3,000 rev. per min. is subject to commutator troubles which, in spite of many ingenious devices, such as the radial commutator, are not easily overcome; so that a 5,000 kilowatt set in a single machine appears to be the limit for safe and efficient operation with a direct coupled turbo-generator.

If a larger power from one set is required, resort must be made to one of two alternatives. The first is to use a turbo-alternator, running at 3,000 or 3,600 revolutions per minute, in conjunction with a rotary converter. This forms a combination which, in certain cases, has distinct advantages.

This combination is particularly suitable when direct-current power must be supplied to several points some distant apart, when the transmission losses and cost of mains can be kept to a minimum by generating at a moderate or high voltage, and transforming down at the sub-station where the rotaries are installed. In many instances direct current is essential for a part of the system

only, while the remainder can be served more efficiently by an alternating supply, a case for which the rotary converter plant is peculiarly suitable. With such a mixed system of distribution the rotary has the further advantage that it can be inverted, taking direct current from sets with which it works in parallel, or from a battery, and supplying alternating current into the mains, thus helping out the alternating current sets in case of a breakdown. A further advantage arises if there is a linking up of several generating stations, because small direct current stations will receive alternating current from the trunk mains and convert it into direct current by means of a rotary, thus having their main-turbo-alternator sets as a stand-by; whereas, in the case of either the direct connected or geared direct-current generator, it will be necessary to use rotaries.

The other alternative is to use double helical turbine gearing to reduce the speed of the turbine to that most suitable for an engine type direct-current generator; the speed of the former is usually between 3,000 and 4,000 revolutions per minute for units of moderate size. The turbo-alternator rotary plant does not suffer from the limitation in desirable size which applies to direct coupling, and also, to a lesser degree, to the use of mechanical reducing gears.

WELDED SHIPS

By T. J.

WELDING cast steel sections together into ships is one of the latest propositions for speeding up shipbuilding. Briefly the idea is to build a hull in sections, each a casting as large as the conditions will allow, and to weld the castings together electrically by an arc method. One casting might constitute the bottom of the vessel for a section eight feet in the dimension lengthwise of the ship; another casting would form practically one side of the hull for that section, and a third the corresponding side opposite; a fourth casting would form part of the deck framework or the stiffening between the upper parts of the sides. The scheme is thus to build a large number of substantially identical sections, so that the work may be carried out in duplication in many centres and at the same time it is intended to afford a means of adding rapidly to shipbuilding capacity without depending upon the rolling mills, which are already fully engaged. Midship sections would, of course, be duplicated to a large extent, and then for the corresponding parts of standardized ships the identical castings would be used.

The abutting edges of castings would be bevelled to form the V-shaped grooves used in electric welding, and by means of interlocking lugs and overhanging ends the cast sections would be drawn together to bring the edges into exact registration, to be welded electrically. In the size of the castings section 8 ft. by 30ft. might be used or even larger if the plant permitted it. The grooves are on the inside of the hull, leaving the outside of the ship without projections other than the minute ones corresponding to the surface of a steel casting untouched from the sand. The only work contemplated necessary on the outside would be the removal of chipping of the steel fins following the use of built-up forms of mould, which may be used for the large castings.

The inner skins of the vessel to form bulkheads, ranks and bunkers, may be composed of rolled-sheet metal welded to the decks, beams, frames and plating. There would be the necessity in this type of construction for the castings to be reinforced to secure strength to the hull itself as well as to provide for satisfactory casting results. On a close examination of this method it cannot be said that there is a great likelihood of its having much success, as the work involved might very possibly be lengthened through broken castings, and riveting by pneumatic power is not yet out of date or superseded by any more successful method.

CONCRETE SHIP SHOWS LONG SERVICE

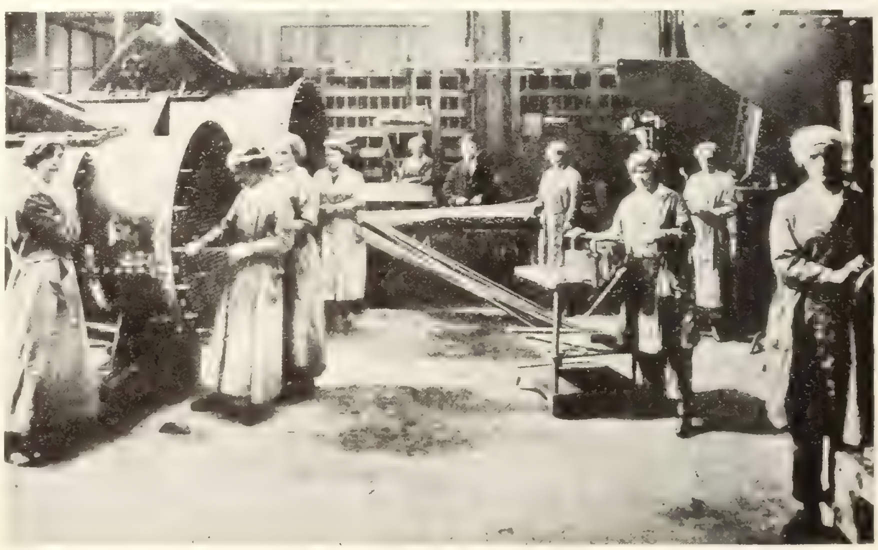
THE first reinforced vessel was in the form of a small boat built in 1849 by a Frenchman named Lambot, at Miravel, and the boat is still in service after a practical test of 68 years. Toward the end of last century the possibilities of reinforced concrete for all kinds of structural work began to be more widely recognized and the material was applied to the construction of vessels of various classes in different parts of the world.

One of the first examples was a floating chalet supported by a reinforced concrete pontoon, measuring 67 feet long by 21 feet wide, built in Rome in 1897. Other barges, lighters and pontoons followed in fairly rapid succession, a Roman firm being most enterprising in the new branch of the work. By the end of 1912, they had constructed at least 20 vessels of the lighter class and over 60 pontoons for floating bridges. In Germany many reinforced concrete vessels of the motor launch and barge types have been constructed. In North and South America, a good many barges and pontoons have been made in reinforced concrete during the last ten years. Typical examples are furnished by a barge in Ontario, 81 feet long by 24 feet beam by 7 feet deep; a fleet of lighters, 100 feet long by 30 feet beam, built at San Francisco for the coasting trade; several lighters and pontoons on the Panama Canal; and some scows 112 feet long by 28 feet beam built at Fairfield.

From the examples cited it is evident that reinforced concrete has earned a definite claim to be regarded as a real shipbuilding material, particularly for vessels of moderate size. The material possesses obvious advantages for the building of many useful types of craft. Apart from ships, barges and pontoons, there are other types of floating structures in which reinforced concrete can be employed with advantage. The most interesting example of the caisson class is furnished by the "Batterie des Maures," a torpedo testing station which at present forms a kind of artificial island in the Mediterranean. The structure was built partly in a dry dock, and completed at moorings outside the dock. The battery was then towed by a couple of steam tugs for a distance of some 30 miles through the sea and sunk upon a prepared bed in deep water. When in readiness for its voyage across the sea, the battery had a displacement of 2,600 tons and drew 26 feet of water.

While of less striking character than this structure, reinforced concrete caissons for pier and jetty construction are of practical interest.

It is frequently contended that saline substances in solution damage the concrete. Authorities state, however, that while badly made concrete has suffered deterioration in a few cases, there is ample evidence of the fact that correctly proportioned and carefully prepared concrete is not injured by prolonged immersion in sea water.



Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

KEYBELL-A. E. AMES COLLISION

At the Wreck Commissioner's Court, Montreal, on July 26, 1917, before Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Capt. Chas. Lapierre and Capt. Francis Nash, acting as nautical assessors, a formal investigation was held into the causes which led to the collision between the steamers Keybell and A. E. Ames in Lake Ontario, 24 miles west of Point Peter, on June 29, 1917, as a result of which the S.S. A. E. Ames only, suffered damage.

Mr. A. R. Holden, K.C., represented the owners of the S.S. A. E. Ames, the Merchant's Mutual Line, and Mr. W. R. L. Shanks appeared for the owners of the S.S. Keybell, the Keystone Transportation Company.

In the course of his evidence, the master of the S.S. Keybell, which is a single-screw, triple expansion steamer of 1,254 tons gross and ten knot speed, stated that on the 29th of June, being bound for Ashtabula, when at a place about 24 miles west of Point Peter, which he marked on the chart, he heard distinctly the fog signal of a vessel 1½ points on his starboard bow, 15 minutes before the collision; that he sounded the usual and requisite fog signals,—three short blasts; that though the fog was dense his speed was maintained; that he gave two blasts to the oncoming vessel, which was answered by the same signal; that the oncoming vessel was steering a parallel course to his according to his first assumption; but in an opposite direction; that he heard but three fog signals from the other vessel; that when they appeared in sight he noticed the S.S. A. E. Ames was going about 11 to 12 knots by the wave she was creating at her bow; that he kept starboarding; that then he saw the masts of the other vessel were open; that he later heard a danger signal and one blast from the S.S. A. E. Ames; that when the impact took place, being a glancing blow, he never stopped, but kept on his speed without attempting to make inquiries as to the fate of the other ship. He did not at any time reduce speed.

The Master of the A. E. Ames, W. H. Montgomery, stated he was 29 years old, holding Master's Certificate No. 5082; that he had been in command of the A. E. Ames three seasons; that she is a steel built, single screw ship, with triple expansion engines, developing a speed of 11 to 11½ knots, carrying a crew of 21, including two deck officers, only one of whom possesses a certificate; that on the 29th of June he experienced intermittent fog; that he was going full speed until he heard the fog signals of a vessel nearly ahead, the wind at the time being fresh from S.W.; but no sea; that it was fog with rain; that he heard a two blast signal, which he answered by two blasts not to give a cross signal, but before this, upon hearing the first fog signals, he telegraphed to his engine room for slow speed; that when the vessels came in sight of each other at about four or five ship's lengths, he sounded the danger signal, several short blasts and put his engines full speed astern; that the ship had not gathered sternway when he ordered full speed ahead and hard to starboard, the bow of his vessel striking against the starboard guard of the Keybell; that he did not stop his vessel; but proceeded on his way, knowing or feeling that no damage had been done to the other ship. He also averred that his vessel was going about three knots when the impact occurred.

The second officers and first engineers of both boats submitted evidence regarding the orders given, speeds and signals.

Finding

In reviewing the evidence, the Court referred to rules 19, 25, 32 and 36, and arrived at the conclusion that the S.S. Keybell, by her violation of art. 19, with regard to speed and bearing of sounds, invited the collision. The master of the S.S. Keybell was, therefore, found in default, and his certificate suspended for one year from July 30, 1917, to July 29, 1918. The master and officers of the S.S. A. E. Ames were exonerated from blame. Both masters were guilty of a misdemeanor through leaving each other without making inquiries and were severely reprimanded on that score.

S.S. HEATHCOTE-KELBERGEN COLLISION

A formal investigation was held on Aug. 2, 1917, in the Court House, Quebec, before Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Capt. Chas. Lapierre and Capt. Francis Nash, acting as nautical assessors, into the causes which led to the collision between the steamers Heathcote and Kelbergen, on July 25, off the coast of Newfoundland, resulting in the loss of the S.S. Heathcote.

Messrs. Hector McInnes, K.C., and W. L. Shanks, appeared for the owners of the S.S. Heathcote, her officers and crew; Messrs. A. C. Chase-Casgrain, K.C., and J. C. Fremont, for the owners of the S.S. Kelbergen, and Mr. Geo. F. Gibson, K.C., for the Master of the S.S. Kelbergen.

Captain Andrew Dalrymple Muir of the Heathcote, deposed that he holds Certificate No. 024009, that he has been in command since 1901; that he had another collision and several minor accidents; that he left Port au Port, Newfoundland, with a cargo of limestone, experienced foggy weather; but passed, he assumed, about 4 miles off Cape George, then a S.W. course was steered; that the fog became thicker and he could not see further than 500 feet; that he was on deck with his first officer keeping a lookout and had posted a man on the lookout on the lower bridge as well; that he had been sounding his fog signal whistle regularly and reduced speed; that at about 1½ minutes before the collision he heard the whistle of another vessel on his port bow about three points which he immediately answered, putting standby on his engines, and on hearing the second blast, rung full speed astern, the bearstructed. If, in addition, there could be ing of the sound being about the same; that the other vessel appeared in sight at 500 feet distant, and he continued full speed astern, sounding twice three blast signals, and the collision ensued, the other vessel striking him abaft the midship line in the engine room. His subsequent actions were described, including his leaving all logs and ship's papers behind though on board 45 minutes before leaving.

Capt. John Samuel Ledsone of the Kelbergen, avers that he has been master of this ship for about six weeks; but had been in the employ of the same firm for 16 years; that after following Admiralty instructions he made the land, and at about 4 miles off Cape Bay he shaped a course for Fume Point, N.W. ½ N.; that the weather became hazy at 6.42, and he heard the whistle which he thought to be Cape Ray once, and then the fog horn of a vessel six points on his starboard bow; that he immediately brought his ship to a stop; that he could see a quarter of a mile distant; that he saw the loom of the ship,—the Heathcote,—and immediately put his ship full speed astern, and with the action of the wind added to her light draft forward, the vessel swung to port, and at 6.50 the collision occurred, the other ship striking him on the starboard bow; that he kept near and offered his services, the Heathcote was then forging ahead and he had some trouble keeping up with her.

He stated that he noticed a list occuring a while after the impact, and he had offered his services to tow the vessel, as he thought she could float; but at 9.10 she turned turtle and foundered. He deposed that at that point and in that locality he followed the ordinary regulations of the rules of the road, sounding his fog horn regularly; that when his ship, was, as he thought, still or nearly stopped, he put his helm had to starboard, and ordered his engines full speed astern with the intention of offering his

port bow to the other ship and pass astern of her; but the ship acted contrary to his expectations and struck the Heathcote with her stem and starboard bow at an oblique angle.

The chief officers, chief engineers and others gave corroborative evidence regarding events, more or less corroboratory, but not bringing out any new salient points.

Summary

In summarizing, the Court waived much of the evidence as being of no import on account of its contradictory nature. It was of opinion, however, that the S.S. Heathcote had still some headway on her at the time of the impact, hence a hard to port helm would have minimized, if not prevented the collision. Whilst the Court admits that some precautions were taken by the Kelbergen to avoid the accident, the fact is there that she was the ship upon which devolved the responsibility of keeping clear of the other vessel, rendered doubly so by the fact she had the Heathcote on her starboard side. The Court also acceded that the evidence showed that at the moment of the impact, the Kelbergen had still headway on her, and a starboard helm under these conditions, was a very wrong action, as no ship must cross or attempt to cross the bow of another ship, Art. 22. A port helm under a headway would have been a proper movement and action, and had this been done, the seriousness of the Kelbergen's actions would have been lessened, but as it is, the Kelbergen violated Articles 16, 21, 22, 23 and 29.

Finding

The Court having carefully weighed the evidence adduced, contradictory with regard to the locality where the collision occurred, somewhat differing with respect to climatic conditions and range of visibility, yet for the reasons given in the summary, every movement and action of each ship being carefully reviewed, finds that the Kelbergen is mostly to blame for this collision. There is not an excuse to be found for an action or actions performed in the agony of the moment. From the first hearing of the Heathcote's fog signal, her bounden duty was plain, as article 16 states: No matter at which angle the Court sees the evidence, it cannot find any excusable reason for this casualty.

In view of the above, the Master's Certificate, No. 033,236, of Capt. John Samuel Ledsone, is suspended for a period of three months from the date of the investigation, August 3, 1917, to November 3, 1917.

The Court also found that had the Master of the Heathcote ported his helm, when he saw the collision was inevitable, he would have been exonerated from all blame. For violating article 27, and observing article 21, which did not apply in this case, his certificate was suspended for one month, till Sept. 3, 1917. He was severely censured for lack of forethought in making no effort to save the ship's papers.

The severest censure was passed on the first officer of the Kelbergen for indifference in the discharge of his duties.

It may be stated that the lenient sentence imposed of the Master of the Kelbergen is due to the fact that he passed through a severe ordeal before, on the same voyage, in combating and succeeding in evading an enemy submarine, and for his action in this respect, though not concerned in this casualty, the Court hastens to praise the valor he has shown in this respect. Owing to this bravery, it is with feeling of regret that the Court has to suspend his certificate, yet the circumstances of the collision warrant it.

The officers of either ship are exonerated from all blame for the collision, and it does not appear to the Court that the engineers of the Heathcote, in view of the manner in which the wound was inflicted, and as they were handicapped in adopting measures to control the inrush of water, their pumps being out of service can be held in any way responsible.

S.S. LETITIA GROUNDING

On Aug. 13 and 14, 1917, in the Court House, Halifax, a formal investigation wsa held before Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Commander Chas. White, R.N., and Commander E. Wyatt, R.N.R., acting as nautical assessors, into the causes which led to the stranding of the hospital ship Letitia in the vicinity of Portuguese Cove, within the port of Halifax, N.S., on Aug. 1, 1917,—and her subsequent loss,—while in charge of a licensed pilot whereby one life perished.

Messrs. Hector McInnes, K.C., M.L.A., and W. A. Henry, K.C., appeared on behalf of the owners of the Letitia, the Anchor and Donaldson Line; also the captain and officers, members of the Imperial Merchants' Service Guild. Mr. E. F. Doyle appeared on behalf of the pilot.

Capt. Wm. McNeil of the Letitia stated that he was 55 years of age, duly certificated, and had been in command for over 24 years. His ship was steel built with single-screw quadruple expansion engines, net tonnage 5,763, drawing about 19 ft. 10 in. forward, and about 22 ft. aft, at the time of the casualty. His crew numbered 137, and she was fully equipped with all navigating apparatus. He made Egg Island closer than he expected, having been set by a current; that from there he proceeded on at a slow speed, the weather which was hazy, becoming thick.

He stated that he heard the fog horn of Chebucto Head, and stopped two miles off Chebucto Head; that the pilot came on board at 10.19, the ship being nearly stopped in the water, that hearing a steamer's fog whistle on his port quarter astern, he suggested to the pilot giving full speed ahead in order to get way on the ship, and that the pilot concurred; the pilot had then given the course W.N.W., which caused the Master some surprise, and he expressed himself to the pilot, who said it was all right. He averred that five minutes later he called the pilot's attention to the fact that the ship was still going full speed, and the telegraph was rung half speed; that after the course W.N.W. had been given by the pilot, he, the Master, went and looked at the chart and concluded that he had made a greater distance to the eastward than expected; that he saw some buoys and called the pilot's attention to them and received the reply that they were in the vicinity of Portuguese shoal, that the course was then altered by the pilot to west; that shortly after a dark object loomed up ahead; that he, the Master, immediately put the engines full speed astern, whilst the pilot ordered hard to port, and the ship grounded with a grating sound; that the engines were kept full speed astern for one minute, soundings were taken outside and showed 2½ fathoms forward, 4½ fathoms abeam.

Efforts to move the ship were of no avail, and the wounded were got ashore safely. Next day the ship was abandoned, and the following day a fireman was reported missing.

Pilot Arthur White had been a first-class pilot for six months and during that time had piloted about 200 ships without accident. He corroborated the evidence of the Master as to weather, courses, movements and happening until the time of the stranding.

He stated that he did not know the position of the cutter when he left it in a rowboat; but was told by the watchman on duty, the captain being asleep, that Portuguese buoy bore NW. two miles, and with those instructions and position he gave the course W. NW., when he boarded the Letitia, and that it was customary to get the position from the one on watch. The second officer, chief engineer and others gave further evidence of detail happenings.

Finding

The Court referred to the straightforward evidence of the Master and the Pilot, but were of the opinion that when the course taken by the pilot caused him some surprise, he should have immediately taken some steps to ascertain the exact position, if possible, of his ship, either by awaiting the hearing of same sounds, or creeping slowly along with the help of the lead until a knowledge of his whereabouts was ascertained. What should have caused him to hesitate, nay, to refuse to proceed on that W. NW. course, is the fact that the pilot had told him he had a bearing of the buoy of Portuguese Shoal given him by a pilot in the vessel. Not being an observation of his pilot, his assurance that the course was right, should have been taken with a degree of suspicion.

The Court considered that the circumstances palliated in his favor, and concluded that he erred in judgment in the first and only instance in allowing the pilot to shape a course, which caused him surprise, without making certain observations.

The Court considered it very improper for the pilot to set a course without first ascertaining his position, either by lead or by waiting, after the vessel which was on the port quarter cleared them, to

hear if any sound could be heard, and if none could be distinguished, it was necessary, and the bounden duty of the pilot to feel his way whilst in this course. The peculiar nature of the ship rendered it providential that a greater disaster had not been registered, and it is due to the calm weather at the time, and the strict discipline shown both by the military and ship's staff.

Had it not been for this most objectionable custom of the pilots to take their possible position from another, the Criminal Courts would have been requested to deal with this case, but under the circumstances, having fully weighed every point, the Court cancels the license of Pilot Walter White, No. 24, and the Halifax Pilotage Commission is requested to see that the order of this Court is carried out.

The Court suggests and recommends that a general and thorough inquiry be made into the pilotage system in Halifax in order to bring about a betterment so as to induce the confidence of the shipping public.

MARINE REPAIR TUG WITH WELDING EQUIPMENT

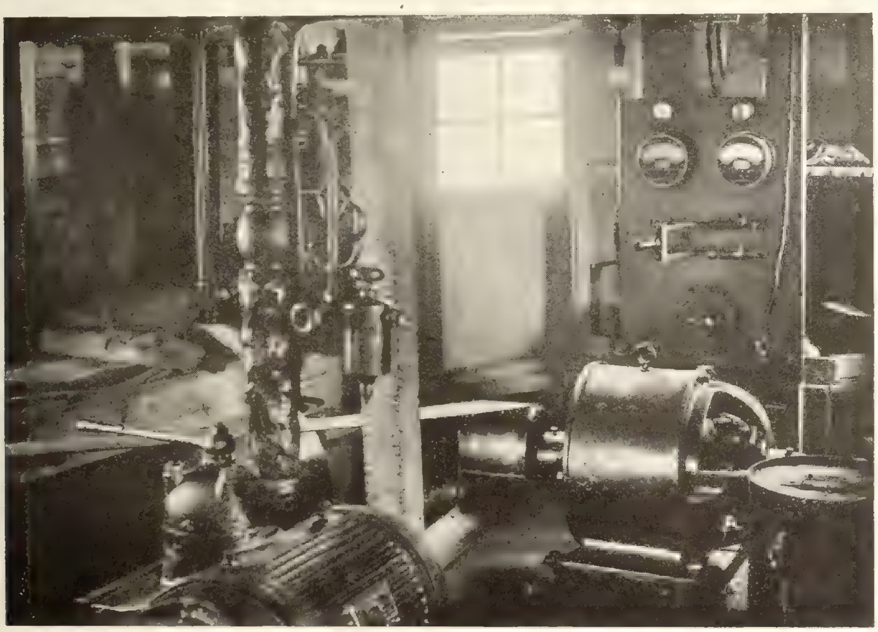
THE characteristic activities that have marked the recent developments in the marine and shipbuilding industry have also necessitated the utilization of every available resource to meet the increasing requirements for additional lake and ocean tonnage. Every conceivable method that would assist in this essential need, has been adopted and pressed into service, to the extent that remarkable results have already been achieved, with still greater ones to follow. A very important factor in maintaining maximum facilities for water transportation is the rapidity with which repairs or alterations can be accomplished upon vessels in transit or in harbor, or such other marine work that requires immediate attention.

The art or science of welding, particularly by the electrical and oxy-acetylene processes, has rapidly advanced to a leading position in engineering practice, both for repairs and general construction work, the marine field being not the least of its many activities. The illustration herewith show the tug Albert, now in the service of the St. Lawrence Welding Co., of Montreal, which has been in operation for several years on the Great Lakes and the River St. Lawrence from Quebec to Fort William. The boat is equipped with a 60 h.p. Fitzgibbon boiler and is operated by a 10 x 10 inch single cylinder high pressure marine engine, providing a maximum running speed of 12 miles an hour. To meet the requirements of general welding practice, the boat has been fully equipped for welding operations, by either the electric or oxy-acetylene process. The installation for the former consists of a 35 horse-power Robb Armstrong horizontal high speed engine, belted to a British Westinghouse 300 ampere generator, complete with switchboard and resistance. For electric welding, 700 feet of insulated cable is carried in reinforced rubber hose, thus providing facilities for effective operation at a considerable distance from the tug.

TUG "ALBERT" EQUIPPED WITH ELECTRIC WELDING OXY-ACETYLENE AND PNEUMATIC TOOL PLANTS FOR SHIP REPAIR WORK AFLOAT.

For the operation of pneumatic tools, compressed air is supplied by a 12x11x12 inch Westinghouse locomotive type air pump, which with receiver, has ample capacity for the operation of three sets of tools. In addition to the working equipment, the vessel is provided with a duplex fire pump and efficient life saving apparatus.

During winter this company operates portable Electric and Oxyacetylene welding apparatus, principally on marine boilers of the several lake vessels that are tied up, and also executes a large amount of digester repair work in connection with pulp and paper industries.



INTERIOR OF TUG "ALBERT" SHOWING ELECTRIC GENERATING PLANT FOR SUPPLYING CURRENT FOR WELDING.

COASTAL TRADE OPEN TO VESSELS OF U.S.

IN view of the scarcity of shipping in inland waters in Canada, resulting from war conditions, the Dominion Government has passed an order-in-Council under the authority of the War Measures Act to permit United States vessels "to engage in the coastal trade of Canada between Lake Superior ports and Montreal, without penalties being imposed, during the remainder of the calendar year 1917." This regulation is to remain in force so long as similar privileges are in effect granted to Canadian vessels by the Government of the United States.

Further to counteract the shortage of tonnage an order has been passed enacting that no application for the transfer of a British ship from a port of registry in Canada to a port of registry outside the Dominion shall be made or granted without the consent in writing of the Minister of Marine and Fisheries. The order conforms to a regulation passed by the British Government under the Defence of the Realm Act forbidding the transfer of a vessel from registry in the United Kingdom to a port of registry outside the British Isles without the consent of the Board of Trade.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

A REMARKABLE OIL ENGINE

By H. P. Hoag

IN a previous issue of this journal the writer described a device evolved during his experience in adapting a line of gasoline engines to burn kerosene. The engine illustrated in the accompanying sketch however, is a real kerosene engine that will start and run on kerosene and has neither carburetor nor electrical ignition. It is the invention of a Danish engineer, R. M. Hvid, and is bound to revolutionize the internal combustion engine, giving as it does the same economy as the world famed Diesel engine.

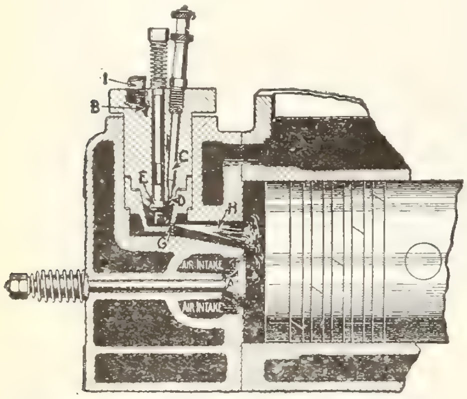


FIG. 1—SECTION OF CYLINDER HEAD SHOWING IGNITION CUP WHICH AUTOMATICALLY FEEDS FUEL TO COMBUSTION CHAMBER.

For those unfamiliar with the Diesel engine it might be stated that first, it is a high compression engine, combustion being caused by the heat of compression which is about 500 lbs. per sq. in., (it being an established engineering principle that a high temperature can be attained by air compression) the resulting temperature being about 1000 deg. Fahr. Nothing but pure air is taken into the cylinder during the suction stroke, then when the piston reaches the highest point of compression, fuel is injected into the cylinder by means of air compressed to about 800 lbs. per sq. in., then cooled. Combustion begins the instant the oil meets the hot air in the cylinder and continues through that part of the working stroke during which fuel is introduced. While the Diesel type gives the very highest economy known to the internal combustion engine, it is never built in small units owing to the expensive apparatus necessary to inject the fuel under such high pressures.

Wonderful as the reliability and fuel economy of the Diesel engine are, the Hvid principle bids fair to outclass the former owing to its extreme simplicity and ease of starting as well as economy, the fuel consumption being half a pound of fuel oil per horse power hour. Another great point of advantage this new type has over the Diesel is that it can be built in small sizes which of course is out of the question with the Diesel type as explained above. Think of an engine, without carburetor batteries, magneto, spark plug, or wires, or the application of any external heat, that will start and run on most any kind of oil, such as kerosene, distillate, fuel oil, or crude oil, in fact any kind of oil that will flow, machine, fish, lard, linseed, olive or peanut oil. This type of engine is now being built by several firms. It was recently the writer's privilege to investigate several of the Hvid type engines now building in the United States both stationary and marine, which proved very interesting indeed.

In this new principle combustion is obtained by the heat of compression as in the Diesel, but the secret of the new system is in the patented fuel cup which times the ignition and represents the only method by which combustion by compression can be easily controlled.

In the sectional view the burning oil can be seen at H, the principle of operation being as follows. During the suction stroke, pure air only enters the cylinder through the intake valve. Oil is admitted by valve E, the quantity being varied by needle valve C, which is under control of the engine governor. As the piston returns and compresses the air to about 450 lbs. per sq. in. the temperature rises to about 950 deg. Fahr. and heats the small fuel cup red hot which brings about a partial combustion of the fuel oil in the bottom of the cup, causing the pressure in the cup to immediately rise above the air pressure in the cylinder which forces the hot oil out through the small pin holes in the cup into the cylinder when it comes into contact with the heated air in the cylinder and burns as shown at H, forcing the piston forward on its power stroke. It will be seen that this new principle incorporated into a substantial design, doing away as it does with all electrical aparatus for igniting the charge, must result in simplicity and reliability and in turn supersede the gasoline engine for at least stationary, portable and marine work.

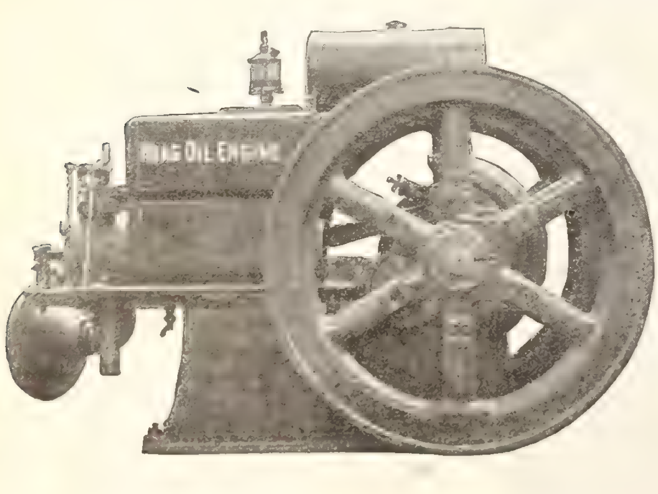


FIG. 2—SIDE VIEW OF THE HOAG OIL ENGINE.

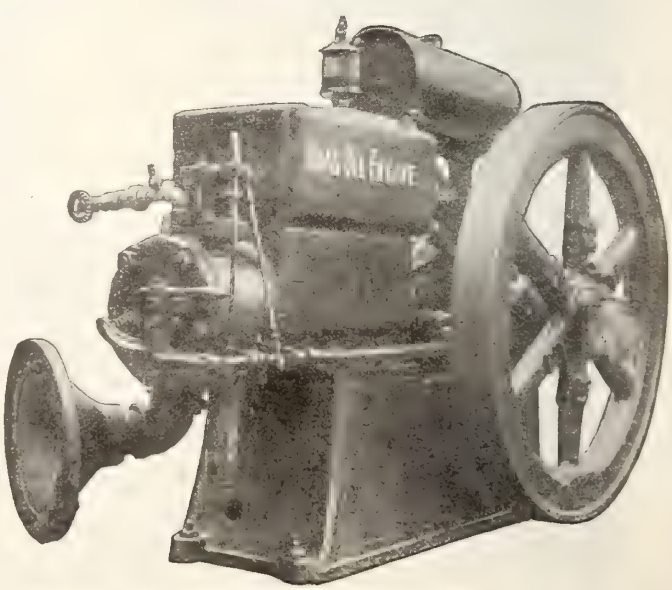
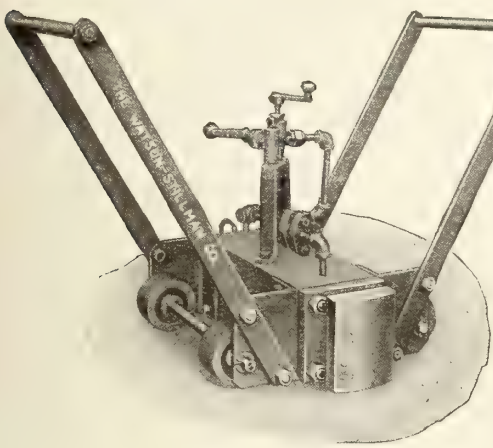


FIG. 3—VIEW OF VALVE AND GOVERNOR GEAR. NOTE ABSENCE OF COMPLICATED MOVING PARTS.

HYDRAULIC BENDER FOR SHIP FRAMES

A NEW design of bender for handling heavy steel shapes for ship frames, deck beams, etc., has just been brought out by the Watson-Stillman Co., New York. It is compactly arranged and is built as light as is consistent with the work it is intended to do.

The machine consists of a cylinder, ram and operating valve, mounted on broad rollers, with a handle on each side so that it can be moved quickly to the required positions on the bending slab, thus making it possible to bend long members to template without reheating and with a minimum of labor.



HYDRAULIC BENDER FOR SHIP FRAMES, BEAMS, ETC.

The necessary resistance of the cylinder is obtained by means of a loose pin which fits into the holes in the bending slabs and serves as an abutment for the machine. The ram is double acting, and its movement is under perfect control at all times, both forward and returning; provision is also made to prevent overstroke.

As illustrated, the machine is equipped with a screw stem stop and release valve; a single lever operating can, however, be furnished if preferred. Any suitable pump can be used as a source of power supply, although accumulator service is preferable. The movement of the machine as shown is at right angles to the axis of the ram, but can also be arranged parallel to it.

The stroke of the ram is 10 in., and with a working pressure of 1,500 lbs. per square inch exerts a force of 18 tons, which can be increased to 20 tons, with 1,750 lbs. per square inch. The weight of the apparatus is 750 lbs.

"MICHELL" THRUST BEARINGS

WITH a view to manufacture in quantity and placing them on the market on the same basis as that on which ball bearings have long been sold, Broome & Wade, of High Wycombe, Berks, England, are now standardizing certain sizes of Michell thrust bearings, says "Engineering."

One form of standardized design is illustrated in Figs. 1 and 2. In this case the thrust collar (a) is bored to a barrel section and instead of being clamped between its spherical seats is loosely held, as is indicated by the space shown between the washer (b) and the opposing face of the seat (c). It is thus capable of taking slight tilts so as to distribute the load equally, in spite of any bending or deflection of the shaft. The collar transmits the thrust to the series of pivoted blocks or pads shown in position at (dd)—of these one set serves to take a thrust and the other a pull. Provision is made, it will be seen, for a continuous supply of oil. This pattern, being entirely enclosed, is suitable for use on pumps, fans or worm gears.

Another form of standardized thrust block is shown in Fig. 3. Here the bearing is not complete in itself, but is designed to fit into seats machined for it in the gear casing or whatever other machine part to which the bearing is to be applied. In this case the blocks are, it will be seen, mounted on two retaining rings. These, when the bearing is mounted in place, fit on bevelled seats, sufficient freedom being allowed to permit of the pressure being fairly distributed over the pads. The rings are prevented from being carried round with the revolving shaft by feathers on the houisng of the machine. This pattern is made in sizes to fit shafts from 1 in. up to 3½ in. in diameter, and to carry loads from 1,000 lb. to 8,000 lb. In this case the pads pivot about a point contact, whilst in the case of the pattern represented in Figs. 1 and 2, which is intended for heavier loads, the pads have line contact with the housing. Both types of bearing can be run at very high speeds, since centrifugal action in no way affects their working. With loads of 400 lb. to 500 lb. per square inch the coefficient of friction is commonly about 0.0015.

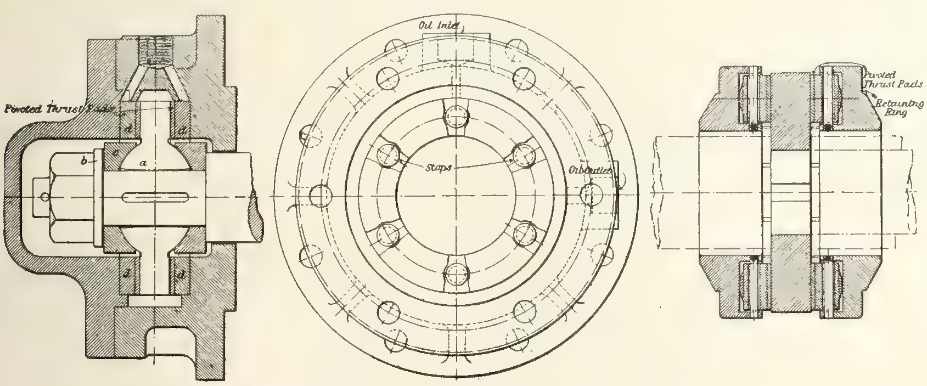


FIG. 1. FIG. 2. FIG. 3.

MICHELL THRUST BEARING DETAILS.

Screenings

Proud mother of young Corporal Jones: "You've heard about my boy, of course, Mrs. Evans?"

Mrs. Evans: "No. What is it?"

Mrs. Jones: "Why, just think—they have made a cockerel of him!"

"And how do you find school, Harold?"

Rather difficult, sir. The teachers are inconsistent. In English composition we are told to be original. In arithmetic we are all expected to get the same answer."—Louisville Courier-Journal.

A nervous man at the opera sat behind a pair of those persons who explain the plot until his endurance was exhausted. Then he leaned forward and said:

"Excuse me, will you speak a little louder? Sometimes the music prevents my hearing what you say."

"Dear Clara," wrote the young man "pardon me, but I'm getting so forgetful. I proposed to you last night, but really forgot whether you said yes or no."

"Dear Will," she replied by note, "so glad to hear from you. I know I said 'no' to some one last night, but I had forgotten just who it was."

A certain learned Queen's counsel was arguing a commercial case before a learned judge. In doing so, he had occasion to speak repeatedly of an "eccentric," and the judge at length asked him what an eccentric was. The magistrate said he was familiar with the term as applied to individuals, but not to things. The Queen's counsel at once complied. "An eccentric," he said, "is a circular disk whose centre is not in the middle."

"I tell you, gentlemen," said the great explorer to the crowd in the hotel smoking room, who were listening breathlessly, "you can't imagine what things are like out in the Arctic regions!"

"Oh, I don't know!" said one. "Even if we haven't seen it, we can imagine what it feels like!"

"I doubt it. It's impossible until you've seen it; until you've stood there, a small, insignificant atom, surrounded by vast stretches of white—"

"Yes, I know. I've been like that."

"Really? Where was it, may I ask?"

"First time I appeared in public in a dress shirt!"

Accessory Equipment of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that determined effort is being put forth to initiate not only the design and construction of standard type ships for specific services, but that of their motive power—main and auxiliary reciprocating steam engine equipment, as well, with a view to acceleration of output and higher duty sea performance, this series of articles, describing and illustrating at least the more important instruments and accessory apparatus of the engine and boiler rooms seems to us more or less timely. The detail features of the various mechanisms will be discussed at length, also their specific application and utility scope.

CONCERNING INDICATOR DIAGRAMS—V.

THE present article concludes the series on Indicator Diagrams, and in view of the fact that those preceding have dealt almost entirely with their reference to the steam engine, it seems fitting that in the present instance something should be said concerning indicator diagrams in connection with modern gas and oil engines.

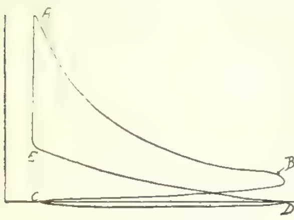


FIG. 26.

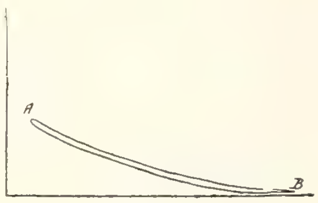


FIG. 27.

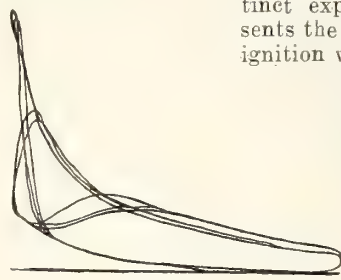


FIG. 28.

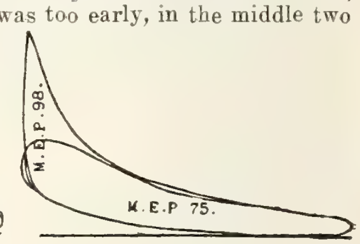


FIG. 29.

Indicating Gas Engines

While the indicator is necessary for determining the I.H.P. and efficiency of gas engines, it can also be made to serve a large number of other useful purposes when the right kind of indicator is used, and when its many applications are fully understood. For instance, the gas engine indicator can be made to show the following: Timing of ignition; over-richness or leanness of the mixture for different conditions of atmospheric pressure and humidity; the proper timing of the exhaust and inlet valve events; whether the exhaust and inlet valve passages are of the right proportion or are clogged up due to deposits of soot, or have too many bends, and other uses as mentioned in the following description.

A well-known type indicator,

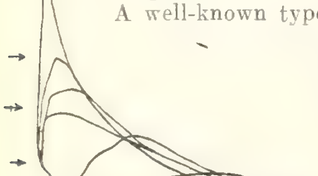


FIG. 30.

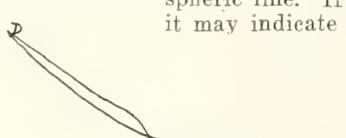


FIG. 31.

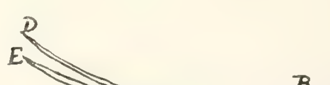


FIG. 32.

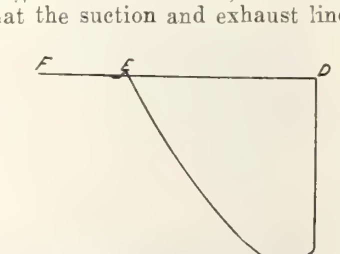


FIG. 33.

especially adapted for indicating gas engines, embodies in its make-up two cylinders and two pistons. The regular piston has an area of one-half square inch, but by removing this piston and inserting a smaller one in a sleeve in the main cylinder, the effective area of the piston is reduced to one-quarter square inch, thus giving double the range of pressure for the same travel of the pencil point. In other words, if a 100-lb. spring is used in connection with the $\frac{1}{4}$-inch piston, each inch height of the indicator card represents 200 lbs. pressure. As the pressure in gas engines often runs to four or five hundred pounds, the advantage of these two pistons will be apparent.

Fig. 26 shows a typical gas engine card taken with a heavy spring, except that the suction and exhaust lines have been exaggerated so as to be visible. The line C to D represents the suction stroke. If this line drops very much below the atmospheric line, it indicates that the area of the suction pipe is too small, that the valve opening is too small, or it may be caused by too many bends or short elbows in the suction pipe; DE represents the compression line. At E the explosion occurs, and the pressure jumps quickly up to the point A. Line AB represents the expansion of the gases. At B the exhaust valve opens. This should be at from 85 to 90 per cent. of the stroke. Exhaust or pushing out of the burned gases, is represented by BC. The exhaust line should be close to the atmospheric line. If the line BC is too high it may indicate that the exhaust line is choked, or it may also be due to the cause mentioned above concerning the suction line. It should be remembered that the area included between the suction and exhaust line represents negative work, therefore this area should be kept as small as possible. The above card is from a four-cycle engine.

Fig. 27 shows a card for the idle stroke of a hit-or-miss governed engine. The top line represents compression and the lower line expansion. If there are no leaks and the cylinder is not cooled too much, these lines should very nearly coincide. Any area between them represents lost work.

Fig. 28 is a card showing eight distinct explosions, none of which represents the best cycle. In the tallest cards, ignition was too early, in the middle two cards it was too late, and in the lowest cards it was very late.

Fig. 29 shows two explosions. The card with the high point represents a correct setting of the valves and mixture of the gases. The lower card was taken when the mixture was too rich in gas, showing that there was a loss of almost 25 per cent. in power by not having the proper mixture.

Fig. 30 shows one perfect explosion and five in which the ignition was too late.

Figs. 28, 29 and 30 are actual cards taken on an engine, while Fig. 26 is an ideal card with suction line exaggerated. Comparing the actual cards, it will be noted that the suction and exhaust lines do not show up. This shows the necessity of using light springs for determining setting of valves.

Fig. 31 shows a card in which pre-ignition occurred. From A to B is the suction stroke, while BC represents the beginning of the compression curve; at C, ignition occurred, and the pressure rose

to the point D while the piston was still traveling forward. From D the gases expanded to E in the usual expansion curve. The card shows that very little useful work is delivered. Pre-ignition may be caused by using gas too rich in hydrogen which ignites without the application of a spark, due to the increase in heat while being compressed. It may also be caused by particles of carbon or other solid matter which are lodged in the cylinder and become incandescent under the temperature of compression, or when any of the water-cooled parts are insufficiently cooled, due to the use of too little water or water at too high a temperature.

Fig. 32 shows the type of card given when back-firing occurs. From A to B

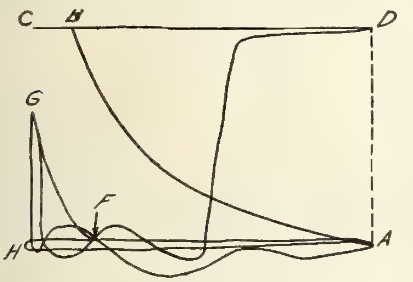


FIG. 34.

represents the ordinary suction stroke, but at F the gas was ignited before the suction stroke was completed, causing the pressure to rise to B. The partly consumed gases were then compressed up to D and expanded again practically along the same line. The result of a back fire is not only the loss of power in the stroke in question but usually causes a mis-fire on the next succeeding power stroke because an ignition takes place while the intake valve is still open, the burned gases go back into the intake pipe and foul the gases contained in it. This is shown by the idle stroke CE in the indicator card.

A back fire may be caused by badly timed ignition, by a leaky inlet valve, in which case the gas in the intake pipe is ignited during the previous explosion

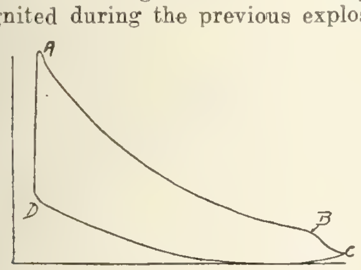


FIG. 35.

stroke, or it may be caused by using a gas of too lean a nature, so that the gas burns very slowly and continues to burn in exhaust stroke. A part of this gas is still burning in the clearance space when the next charge is drawn in. Again, if there are any pockets or small passages, the gas in the pocket may be cooled to a point where it does not ignite readily but becomes heated and ignites in the latter part of the expansion stroke and continues to burn until the succeeding suction stroke, when the incoming charge is ignited.

Fig. 33 shows a typical card taken with a Trill indicator having a one-half inch piston and an eight-pound spring. The line AB is the suction, and as this is only a trifle below the atmospheric line, it will be seen that the intake ports are ample and that no vacuum or negative pressure is produced. The line BE represents compression. This is not shown up to the limit of compression for the reason that the indicator is provided with a stop which limits the travel of the indicator piston and prevents damage to the instrument. Therefore, as soon as the pressure reached the point E, the pencil could not move any further and it traces a straight line to the end of the stroke at F. From F to D explosion and expansion of the gas have occurred, but as the pressures are still above the limit of the spring only a horizontal line is drawn. At D, however, the pressure falls to within the range of the indicator and the quick drop in pressure shown by the vertical line DC is proof that the burnt gases are being expelled from the cylinder without producing any back pressure. From C to G is the exhaust line, during which period the gases are expelled from the cylinder. As this line is only slightly above the atmospheric, little power is being lost. The card is practically a perfect one for a light spring, showing that all of the events occurred at the right time.

Fig. 34 shows a very bad card taken with a light spring and will also serve to show how valuable a good indicator is in detecting improper setting of valves, timing of explosions, etc. From H to A represents the suction stroke, and A to B the compression. It will be seen that the stop on the indicator is reached at B, and a horizontal line is traced to the end of the stroke. From C to D the pressures are above the range of the indicator. If the exhaust valve had been set properly, the line at D would have followed the dotted line similar to the straight vertical line shown in Fig. 33, but the exhaust valve did not open soon enough, therefore the pressure did not start to drop until nearly one-third of the exhaust stroke had been completed. Furthermore, the exhaust valve besides opening too late, closed too soon; this is shown by the rising pressure from F to G, indicating that instead of all of the burned gas being expelled, part of it was entrapped and compressed. This used gas mixed with the new charge fouls it Line GH shows that, as soon as the intake valve opened, this burned gas expanded back into the intake pipe, allowing the pressure to drop down to atmosphere.

All of the above cards not only represent a direct loss in power, but they also interfere with the operation of engines especially when they are direct connected to generators. Pre-ignition and missed strokes tend to slow down the engine, causing a variation in voltage of the generator which, if it is supplying a lighting current, introduces annoying flickering of the lights, or if the engines are direct connected to alternators which are running in parallel these momentary changes in angular velocity set up cross currents and introduce hunting between the generators.

It will thus be apparent that if maximum power and satisfactory operation


FIG. 36. POWER CARD.

are to be obtained from any gas engine it is absolutely necessary that it be indicated occasionally, for, even though the valves may be properly set when the engine is first set up, they are liable to become fouled and will stick, passages will become obstructed and other troubles will creep in unless they are periodically looked after.

The foregoing discussion applies mainly to engines working on the four-stroke cycle. Fig. 35 represents a typical card from a two-port, two-cycle engine. It will be noticed that the suc-

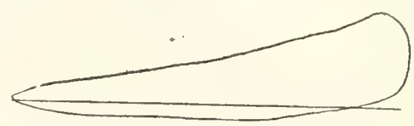


FIG. 37. SCAVENGING CARD.

tion and exhaust lines are absent in this card, the suction stroke being completed in an enclosed crank case or separate cylinder or pump. Point C represents the inlet of the mixture; CD is the compression line; D the point of ignition; DA represents the increase of pressure due to explosion; AB the expansion; at B the exhaust valve opens, and the line BC represents falling pressure due to exhaust. The card of the two-cycle engine would be modified practically the same as that of the four-cycle engine due to improper timing of the ignition valve events.

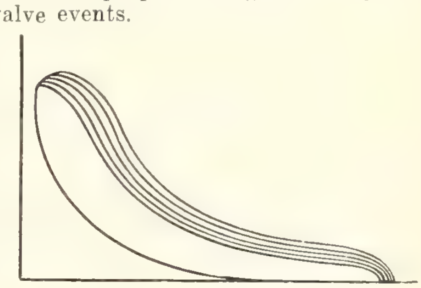


FIG. 28.

By taking indicator cards on gas engines it is possible to so time all the events that maximum power will be obtained. The mixture can be so regulated that maximum explosion pressure is obtained. The effects of different temperatures of jacket water can also be studied.

The horse-power of a single acting, single cylinder four-cycle gas engine is given by the following:—

$$\text{H. P.} = \frac{\text{PLAN}}{4 \times 33{,}000}$$

Where P = mean effective pressure in lbs. per sq. inch = the mean ordinate of the indicator card × the scale of spring used; L = length of engine stroke in feet; A = area of piston in sq. inches; N = number of single strokes per minute = 2 × r.p.m. In the case of a hit or miss engine, N should be taken as the number of explosions per minute and the 4 omitted from the formula.

For single acting, single cylinder, two-cycle engines, the following formula should be use:

$$H.\ P. = \frac{PLAN.}{2 \times 33{,}000}$$

Figs. 36 and 37 are characteristic cards of one of the latest types of high compression, two cycle oil engines. These are actual cards taken on a Nordberg engine recently installed. Fig. 36 represents the power card, a 300 lbs. spring representing an m.e.p. of 75.5.

Fig. 37 is a scavenging card taken with a 10 lbs. spring, and represents the cycle of compression of the scavenging air on the crank side of the engine. This card gives the characteristics of the scavenging air compressed on the exhaust stroke and forced into the cylinder when the exhaust port opens. The purpose of this scavenging air is to remove the products of combustion and fill the cylinder with fresh air as quickly as possible. It is important that scavenging air valves and events be set and regulated by indicator card.

The diagrams Fig. 38 are characteristic of the modern type of Nordberg-Carels Diesel engine, and illustrate the result due to the variation of the governor adjustment. which varies the injection of the fuel.

Indicator Spring Data

Scale of Spring	Steam Pressures Recommended: Not over 150 R.P.M.	Not over 300 R.P.M.
8	12	8
10	18	12
12	22	16
16	30	24
20	40	32
30	70	55
40	90	80
50	110	95
60	135	110
70	150	125
80	170	140
100	200	200
125	260	260
150	300	300
200	400	400

The above are conservative figures furnished by the Trill Indicator Co. They state, however, that they are willing to guarantee their instruments up to 600 r.p.m.

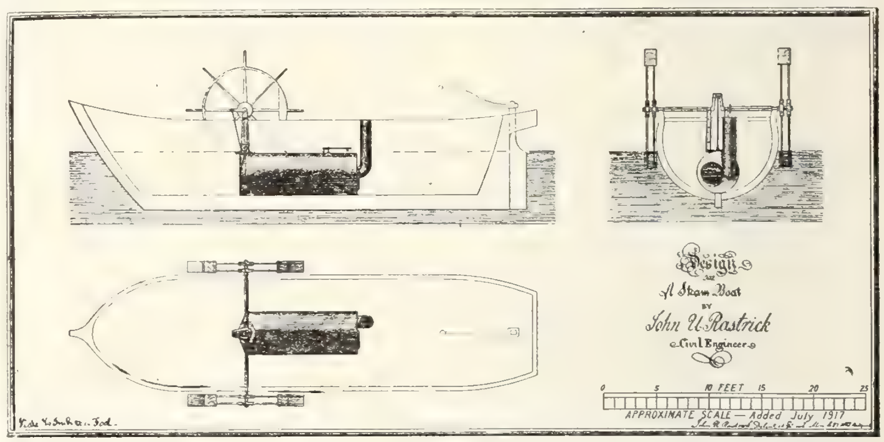
AN EARLY STEAMBOAT

THE present advanced state of marine engineering causes peculiar interest to attach to the accompanying illustration of a design for a steamboat by John U. Rastrick, who built engines for Richard Trevithick in the beginning of the 19th century. The illustration, signed by John U. Rastrick, March 27, 1813, Bridgnorth, is reproduced by courtesy of our contemporary *The Engineer* which publishes the following letter from the owner, Arthur L. Johnson, Limited, of Middlesborough, England, who wrote: "I picked up at a country book-shop the large folio volume of plates to Tredgold's Works, dated 1839, London, John Weale, which contained, stuck in a back page, a drawing which must surely be of interest to all engineers, as it is signed by John U. Rastrick, March 27, 1813, Bridgnorth, and is a plan, sectional elevation and end elevation of a design for a steamboat. The engine is set in the end of the boiler, and is high-pressure, and directly connected to the crank shaft, on which are mounted a pair of paddle-wheels. The workmanship of the draughtsman is admirable, and the shading would probably not be worth the trouble to-day. The picture is of interest, as Rastrick was the founder who built the engines of Richard Trevithick, and it would please me to know if Trevithick ever had such a ship constructed, and if he planned it himself. The scale of the drawing is ¼-in. to a foot, and the ship was intended to be about 40 ft. long, 11 ft. 6 in. beam, and 5 ft. 6 in. draught."

Commenting on the picture our contemporary says: "Simple as it is, it is an extraordinarily interesting link in the history of steam navigation. The Trevithick influence is obvious. The engine is a high-pressure one—there is no condenser—and all the complication of side-levers or overhead beams is avoided. The whole design is as direct and simple as could be desired. The cylinder is apparently single acting, and we gather that a trunk piston, with the connecting-rod coupled to a gudgeon pin, was proposed. It is almost buried in the domed end of boiler, which has a fire-flue at one side and a return flue at the other. The counterbalance weights in the paddles will be observed. The whole thing is excellent in its simplicity and directness of purpose."

"We are quite unable to say whether this "ship," as Mr. Johnson calls it, though pinnace is probably a better name, was ever constructed, and if any of our readers can give any clue to it, we engineers would be greatly indebted to them. Trevithick, as readers of his "Life" know, was deeply interested in steamboats, and in Vol. I, page 352 of his "Life," a letter by him to Hazeldine, Rastrick and Co., Bridgnorth, dated November 13, 1815, Penzance, may be found. In it he says, "Enclosed you have a drawing for the towing engine for London, which you will execute as soon as possible." It is clear from the context that the engine in question was meant to drive a screw propeller, so that even if it were not two years later than the Rastrick drawing, it would be obvious that the same vessel is not referred to."

"It may be of interest to recall that Fulton's steamboat, the Clermont, was completed in 1807, and that John Robertson's "Comet" was built in 1812. Hence Rastrick—or Trevithick—could not be regarded as a pioneer; but it must, at the same time, be admitted that the simplicity of the design, and the obvious intention to use high-pressure steam, are matters of the highest interest."



EARLY DRAWING OF STEAMBOAT DESIGNED BY JOHN U. RASTRICK IN 1813.

U.S. to Limit Her Exports. — The United States Government has published a conservation list of materials which cannot be exported except under license. The ruling is intended for Northern European Neutrals but also affects Canada. The list follows: "Acetone; alcohol; aluminum; ammonia salts; ammonia nitrate; anhydrous ammonia; arsenate of lead; arsenate of soda; boiler tubes (iron and steel); butter; carbolic acid (phenol); castor oil and castor beans; chrome nickel, steel; cotton linters; cyanide of sodium; ferro-manganese; phosphoric acid; phosphorus; pig iron; potash and chlorate of potash; ferro-silicon; ferro-vanadium; flax, glycerine; iron and steel plates, including ship, boiler, tank and other iron and steel plates half inch thick and heavier and wider than six inches, whether plain or fabricated; mercury salts; nitrate of soda; nitric acid; nitric salts; potassium salts; saltpetre; scrap iron; scrap steel; searchlights and generators (suited for army or navy use); sodium sulphite; spiegeleisen; stearine and stearic acid; steel billets; steel blooms; steel ingots; steel sheet bars; steel slabs; sugar; sulphate of ammonia; sulphur and sulphuric acid; super phosphate; tinplate; toluol; tungsten; wireless apparatus; wheat; wheat flour and wool rags.

CANADIAN MARINE "HEADLIGHTS"

GEORGE DUNCAN DAVIE, general manager Davie Shipbuilding & Repairing Co., Ltd., Lauzon, Levis, Quebec, was born at Levis, August 19, 1873, son of George Taylor and Mary Elizabeth (Patton) Davie.

After being educated at Berthier Grammar School, Eleco, and Quebec High School, Mr. Davie started in 1890 with Carrier, Laine & Co., shipbuilders and engineers, of Levis, Que., where he learned the business and developed into

GEORGE DUNCAN DAVIE.

mechanical and salvage engineer, ultimately occupying the position of general manager to the Quebec Salvage & Wreckage Co., Ltd. In 1913, Geo. T. Davie & Sons sold their shipbuilding and repairing plant at Lauzon to the Davie Shipbuilding & Repairing Co., Mr. Davie continuing as general manager of that firm, which position he had previously with his own firm. Mr. Davie's ability is indicated by the fact that he was the recipient, in December, 1916, of a gold watch bearing the following inscription: "Presented by the Directors of the Submarine Boat Corporation, U.S.A., as a token of appreciation for the great energy shown by him in the construction of 325 80-foot motor launches for the British Admiralty at Lauzon, Levis, Que., during 1915 and 1916."

A study of shipbuilding methods on the Clyde and also in American yards has enabled Mr. Davie to impart a high degree of efficiency to his plant and practice, he being further a member of the Naval Architects' Institute of Great Britain.

Protestant in religion, Mr. Davie's society affiliations include I.O.O.F. and Royal Arcanum. His residence is Lauzon, Levis, Quebec.

—Photo, courtesy International Press.

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Vol. VII SEPTMBER, 1917 No. 9

PRINCIPAL CONTENTS

RESTORING THE WORLD'S SHIPPING

IT has been said that we will win the war if we can successfully combat the submarine menace, but the latter, to all appearance, will only be accomplished by concentration on merchant shipbuilding. Without doubt a fair percentage of enemy submarines have been destroyed, trapped and captured, but these when assessed at their proper value are little more than incidentals in the whole big struggle for ultimate supremacy. The weekly report of vessel sinkings indicates only too clearly to which side the mass of the victims belong, and bears witness to the fact that nothing of worth-while effect has been devised, or at least is yet operative, that will deal the death-blow to the undersea boat activity.

Among men who have been watching the shipping situation closely, there is a disposition to believe that we are not keeping pace with Germany's submarine construction and equipment development as we ought, particularly in the arming of our merchantmen. The steadiness or even lowering of the weekly sinking record is not in their estimation the real criterion; rather is it the apparent paucity in number of vessels that successfully resist submarine attack. It is believed that the power of offensive of Germany's U-boats has been materially increased as regards their gun equipment over that of our armed merchantmen; in consequence, not a little concern is evident lest the destruction waged by these pirate craft become immediately or in the early future still more intensified.

There is to-day less disposition to talk of shipbuilding achievement than there was a few months ago, it having been realized in the interval that suiting action to words is less easy than at first sight appears. It is estimated that the Allies began this year with 20,000,000 gross tons of merchant shipping. Britain's losses for the period elapsed are believed to be at the rate of 5,000,000 tons per annum, against which the total of 2,000,000 tons for the last completed year of the world's shipbuilding makes a rather unfavorable comparison, and seems to dispose of the possibility of the immense new construction programmes launched a while ago reaching anything like the figures aimed at.

Britain's best shipbuilding performance in pre-war days was around 2,000,000 tons per annum; nevertheless, Premier Lloyd George has promised that 4,000,000 tons will be produced this year. Again, stupendous figures of tonnage output are being credited as likely to come from the United States. In the minds of those in close touch with the shipbuilding industry, irrespective of its nationality location, and who are able to gauge with a substantial degree of accuracy the whole situation with its myriad accessory disabilities, the opinion exists that in the coming year a deficit of 5,000,000 tons of shipping will have to be made good, and that its detail participation by the Allies will call for 2,000,000 tons from Great Britain, 1,500,000 tons from the United States, and a like total from France, Italy, and Japan combined. We consider even the foregoing a pretty tall order, and shall look forward expectantly to its fulfillment.

It is a good idea, however, to set a figure of achievement, if same be reasonably and judiciously determined, and be made the absolute minimum. Britain's four million tons for this year is to our mind a particularly rash estimate of her shipyard capacity, aside altogether from its being war-time; yet there is no disposition to believe that, although her achievement for the period is likely to be much under the figure quoted, her safety and that of the world's civilization will be jeopardized.

The transfer of skilled, semi-skilled, and unskilled labor, from munitions making, should both stimulate and accelerate new tonnage output in Canada, besides enabling metal-working plant executives to concentrate their attention more on what gives promise of being an industry both substantial as well as permanent in character. There is reason to believe that plans are being developed for a much enlarged shipbuilding effort in Eastern Canada in the coming months, the relief from shell-making admitting now of greater freedom of action. If we choose, shipbuilding, with its accessory industries, for the next decade in this Dominion may readily surpass in proportions the munitions activity of these past thirty months or more.

Marine News From Every Source

The Merchants Shipbuilding Corporation has been incorporated at Victoria, B.C., to carry on a shipbuilding business at Vancouver, with a capital of $500,000.

The Three Rivers Shipyards, Ltd., has been incorporated at Ottawa, with a capital of $49,000, to build ships of all kinds at Three Rivers, Que. The incorporators are: T. M. Kirkwood, of Toronto, also A. Chouinard and L. Heyman, of Montreal.

Midland Shipbuilding Co. has been incorporated at Ottawa by Norman L. Playfair, Marcus Smith, and Thomas C. Luke, all of Midland, Ont., to carry on the business of shipbuilders in all its branches at Midland, Ont., with a capital of $1,000,000.

Sault Ste. Marie, Ont.—The red lights on spar buoys 4A and 4B marking the channel in the vicinity of the wreck of the steamers Pentecost, Mitchell and Saxona have been discontinued. The unlighted buoys will be continued in commission near Pipe Island.

British Mercantile Marine Losses.—Since the outbreak of the war, 6,627 officers and men of the British mercantile marine, exclusive of those in the pay of the Admiralty, have lost their lives, according to a statement made in the British House of Commons on August 20 by Sir Albert Stanley, President of the Board of Trade.

Halifax, N.S.—Adam B. McKay of Hamilton, Ont., will be present at the launching of the second large schooner he has had built here this year and will make a contract for the building of a third. The first schooner, the Letitia B. McKay, he has already sold at a profit over the contract price of $70,000. The next one to be launched at Port Greville will be named the Adam B. McKay, the first one being named after his wife.

St. John, N.B.—J. M. Smith, engineer for the St. John Shipbuilding Co., was in the city recently and surveyed the site for the proposed shipyards. He expressed himself as well satisfied with that chosen, and left for Montreal, where he will prepare blueprints for laying out the yards. In a week or so tenders will be called for the erection of buildings, grading, etc., and the work of getting the yards ready will be rushed as rapidly as possible.

Lower Marine Rates.—It is reported from New York that in spite of the rather less favorable report of the British Admiralty there are indications of lower rates even to Europe. Some houses have lowered their schedules to Spain, Denmark, Norway, Sweden and Holland for neutral steamers by 1 per cent. Rates on off-submarine routes continue to be easier without marked changes. To Great Britain 8 per cent. on outward cargoes remain the general minimum.

Victoria, B.C.—The Whalen Pulp & Paper Co., which is engaged in establishing the largest industrial plant on Vancouver Island at the new town of Port Alice, near the head of the Southeast Arm of Quatsino Sound, will lay down two keels at a time and will keep on building ships until it has enough of them to handle its export trade.

New Westminster, B.C.—H. A. Bayfield, formerly superintendent of dredges here, was in the city recently inspecting possible sites for the assembling shop which the Imperial Munitions Board will probably establish somewhere on the Coast to assemble machinery and engines for the vessels now being built at various shipyards. Sites will also be inspected at Victoria and Vancouver.

Ottawa, Ont.—In the House on Saturday, a vote of $600,000 was discussed for two wooden ships of 3,500 tons each, to be built by the firms of Wallace & Harrison of Vancouver, at a cost of $230,000 each, the vessels to be equipped with Diesel oil engines. The item was allowed to stand over, because the shipbuilding firms had cancelled their tenders, and had offered to go ahead on a cost plus ten per cent. basis.

Windsor, Ont.—Plans have been filed with the Canadian Government by a local law firm, acting for the Canadian Steel Corporation, for docks at Ojibway to cost $250,000. It is stated that the plans include a marine slip, harbor, docks, and wharves. A canal running through the corporation's property for 2,500 feet, which will be 200 feet wide and 25 feet deep, will be dredged to accommodate boats. It is proposed to build docks on the banks of the canal, while another dock a thousand feet long is planned for the river front.

Concrete Ships Being Built in Montreal.—Concrete shipbuilding has begun in Montreal under auspices which are likely to bring it to a successful issue, if the scheme proves at all practicable. The work of construction is being carried out by the Atlas Construction Co., which has had a great deal of experience in the handling of cement and reinforced steel from which the hulls of the boats will be made. One boat is now under construction at the Montreal Dry Dock Co.'s plant, and will be ready to travel under her own steam about the 15th of October. She is about 200 feet long, the hull having a thickness of 3 to 5 inches.

Midland, Ont. — Contracts for the buildings in connection with the McDougall-Smith Shipbuilding Co.'s plant in which Capt. Alex. McDougall, is interested will be let shortly. The size of the buildings are as follows. The carpentry shop will be 50 by 200 feet, two storeys in height. There will be two one-storey workshops, each 32 by 300 feet; a two-storey office building, 65 by 50 feet; a building in which will be rest rooms and other conveniences for the men, and a boiler house and oil house. All the structures will be of frame. It is intended to rush construction and have the plant ready for operation by late fall.

Vancouver, B.C.—The Canadian Fishing Co.'s newest vessel, the Tartoo, ran her trials on Aug. 16. This concern now has three boats, the Nesto, Tasso and the Tartoo, the last-named being the most modern and up-to-date type of seine craft. The Tartoo is 60 feet long, 15 feet beam and 5½ feet draft. A 50-horsepower gas engine gives the vessel a speed of ten miles per hour. The hold has a capacity of 10,000 sockeye salmon or its equivalent, 72,000 pounds. The boat was built by Ferrier & Lucas, costing about $9,200. The plans for this new vessel were furnished to the Royal Commission on Fisheries, which has suggested them for a standard seine craft.

Harbour Appropriations for Ontario.—The Dominion Government appropriations for harbours and rivers in Ontario include: Bayfield, repairs to piers, $10,700; Bruce Mines, dredging, $21.000; Burlington Channel, in full and final settlement of all claims of D. G. Stewart in connection with his contract for construction of revetment wall, $10,441.59; Burlington Channel, repairs to pier, $1,050; Collingwood, harbour improvements, re-vote $72,600, $75,000; Goderich, harbour improvements, $51,000; Kingston, dry dock, renewal of revetment walls, $33,000; Oshawa, repairs to pier, $2,100; Owen Sound, repairs to wharf, $4,000; Port Colborne, repairs to east breakwater, $1,750; Port Dover, repairs to piers, $6,000; Port Hope, harbour improvements, $13,500; Sault Ste. Marie, wharf improvements, $1,500; Thornbury, repairs to pier, $2,000.

Toronto, Ont. — The Toronto Ship Building Co., has been given a permit to erect a mill and mould-loft on their property at the foot of Cherry street, at a cost of $8,000.

Halifax, N.S.—The lumber laden steamer from a St. Lawrence River port, which went ashore on Amherst Island, in the Magdalens, on August 27, has been successfully floated, and arrived at Halifax under her own steam.

Ottawa, Ont.—A vote has passed in the House to appropriate $600,000 for the construction of wooden ships in British Columbia. When completed they will trade between Pacific coast ports and Atlantic coast ports.

"Saxona" Raised.—The Saxona was raised on September 13 by the Reid Wrecking Co. from the bottom of the St. Mary River, where she sank following a collision with the Pentecost-Mitchell on May 14 last. She has been brought to Sarnia for extensive repair and overhaul. The Reid Co. purchased the vessel from the underwriters.

Liverpool, N.S.—The auxiliary tern schooner Bianca, built by the Gardner Co. of this port, has been placed in commission. The new vessel is 129 feet long, 33 feet beam, and 408 tons gross. She is fitted with a 100 h.p. Fairbanks crude oil engine, and has a speed of 6¼ knots. Capt. Mark Burke, of Carbonear, is in command. The Bianca was built for Bowling Bros., of St. John's, Nfld.

Vancouver, B.C.—This port will have one of the most up-to-date docks on the Pacific Coast when the construction of the new shed at the Government wharf, tenders for which, it is said, will be called for within a few days, is completed. The building of the new shed will be effected from the $110,000 which has been apportioned a few days ago for harbor improvements, and will be 1,000 feet long by 110 feet wide. The plans call for the construction of a five-ton portal pier crane on the west side of the new shed.

British Shipbuilding Increase.—Commenting on the rapid increase in shipbuilding to offset losses from the submarine campaign, the Cardiff, Wales, correspondent of the Exchange Telegraph Co., says that two supplements published by Lloyds Shipping Register show that between June 8 and July 17 more than 100 steamers, of which 63 are British, were added to the register. Most of these vessels are of large tonnage. The rate of construction is understood to be increasing rapidly.

Vancouver, B.C.—That Government stores and supply depots are to be soon established on the four-acre tract on Industrial Island, False Creek, Vancouver, which was apportioned to it by the Board of Harbor Commissioners has been reported to the board. One half of the site will be for the Department of Public Works and the other half for the Department of Marine and Fisheries, Government dredges, tugs and other craft will be loaded at the island in future, it is expected. The acquisition of the tract by the Government places Vancouver on a par with New Westminster and Victoria in this respect, as before the plot had been donated the Government had not a foot of land in the city on which to build a supply depot.

U. S. Will Build Large Fleet of Steamers.—A report from Washington, D.C., states that the United States Government will build a great fleet of merchant vessels, from 10,000 to 12,000 tons, capable of attaining a speed of sixteen knots or better. Not less than 150 cargo ships, aggregating from 1,500,000 to 2,000,000 tons, will be built under the new Shipping Board plan, and not one of them will make less than 16 knots an hour, while many of them will be capable of 18 knots or more. Diesel engines will be used as far as is possible.

Canadian Vessels in American Trade.—It is figured that Canadian vessels that have entered the trade between American ports on the Great Lakes will move more than half a million tons of ore before their charters expire late this month. The season has been brief but prosperous for Canadian traders who entered American trade. Canadian vessel-owners plan to take early advantage next season of the opportunity offered by the American Government to engage in trade between American ports. Both American and Canadian vessel-owners expect to continue operating late this season, owing to the demand for carriers to move war supplies and foodstuffs.

To Prevent Seamen Deserting.—An Order-in-Council, providing for the apprehension of seamen who desert from any vessel owned or chartered by the British or Canadian Government, or carrying cargo or passengers for any British or Allied Government, has been passed by the Government. The Order authorizes any owner, master, mate, naval or military officer or superintendent to convey such a seaman on board his ship or have him detained in custody until he can be taken back to the vessel. Police officers are required to render such assistance as may be needed to convey men, absent without leave, to their ships. A further section of the Order provides that seamen shall not leave vessels in the classes mentioned without a pass signed by the master, mate, purser or first engineer.

Victoria, B.C.—With the launching of the Malahat, the fourth schooner to take the water from the Cameron-Genoa Mills Shipyard, Victoria, and the schooner Mabel Stewart from the Wallace Shipyard No. 2, North Vancouver, the fifth schooner to be launched for the latter concern, only three more vessels of this type remain to be launched by these yards under the present programme, two of which are nearing completion at the plant of the Cameron-Genoa Shipbuilders, Ltd., and the other being well along at the Wallace yard. After completing the fleet of twelve ships, all of which are of the auxiliary schooner class, and half of which were ordered here and half in North Vancouver, both of the yards mentioned will give all of their attention to the building of wooden steamers for the Imperial Munitions Board.

May Not Move Lake Ships by Welland Canal. — It is reported that the United States Shipping Board's plan to move lake tonnage through the Welland Canal to the seaboard may be abandoned owing, it is stated, to the absence of dock facilities, in which the vessels could be reconstructed after coming through the canal. It will be necessary to cut many of them into sections in order to navigate the locks of the canal. The Shipping Board has communicated with shipping officials at both Montreal and Quebec regarding dock facilities at these ports. Unless docks can be secured in Canada, it is probable that only about twenty steel tugs will be brought to the seaboard from the locks. These vessels can navigate the canal.

Eighty Lake Boats Will Go to Atlantic. A representative of the United States Shipping Board was in Cleveland recently definitely initiating Government plans to commandeer lake freighters for coastwise and trans-oceanic war trade. Figures tabulated by the Government agent, in conference with local shipping experts, owners, builders and tugmen, show that upward of 80 lake boats can be taken to salt water. The Shipping Board's decision will rest upon the report to be made by its representative. The plan is to take every boat posible of passing through the Welland Canal, and thence through the St. Lawrence River to the Atlantic before lake traffic is icebound. The Shipping Board is now making a list of boats under 260 feet length and 43 feet beam, which can pass through the Welland Canal without alteration. Boats up to 520 feet length and not more than 43 feet beam will be cut in two, bulkheaded and towed by tugs through the canal and river.

Harbour Appropriations for Quebec.—The Dominion Government appropriations for harbours and rivers in Quebec include the following: Anse-aux-Gascons, repairs to wharf, $5,000; Anse-aux-Griffon, repairs to piers, $1,500; Baracnois de Malbaie, repairs to approach to the training pier, $1,200; Cap Chat River, improvements, $5,000; Cape Cove, repairs to pier, $500; Cascades Rapids, reconstruction of anchor pier, $1,500; Chaplain, repairs to wharf, $4,500; Chicoutimi, repairs to wharf, $2,500; Cross Point, repairs to wharf, $1,000; Graham, reconstruction of wharf, $3,500; Grindstone, M. I., repairs to wharf, $2,600; Grosse Isle, quarantine station, repairs to wharf, $4,000; Grosse Isle, quarantine station, extension of wharf, $50,000; Isle-aux-Coudres, wharf improvements, $1,200; Laprairie, repairs to wharf and completion of approach, $4,000; Malbaie, repairs to pier, $900; Newport, repairs to breakwater, $1,500; Norway Bay, to repair and improve wharf, $5,000; Point Shea, M.I., repairs in the wharf, $1,500; Riviere - a - la - Pipe, reconstruction of wharf, $5,000; Sabre-vois, repairs to wharf, $1,460; St. Anne de Beaupre, repairs to wharf, $600; Ste. Anne de Chicoutimi, repairs to wharf, $2.800; St. Charles de Caplan,, removing debris and rebuilding outer end of wharf, $2.500; St. Jerome, repairs to wharf, $2,500; St.

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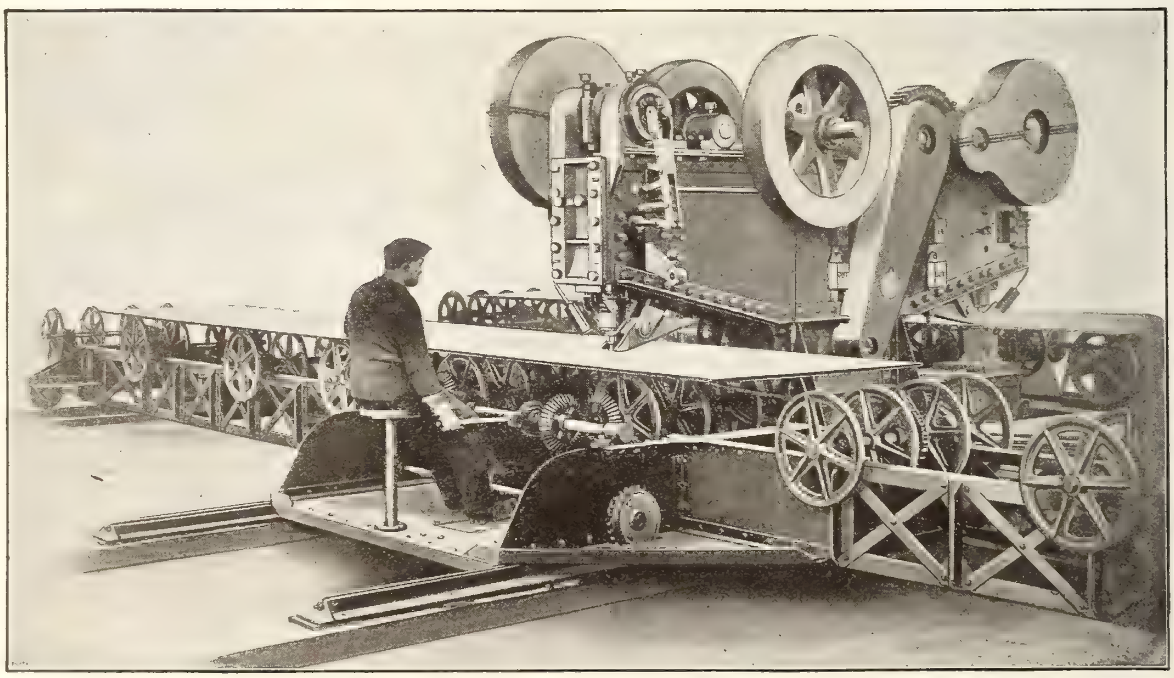
Ulrich, repairs to wharf, $1,200; St. Zotique, reconstruction of wharf, $2,000; Three Rivers, repairs to wharf, $9,500; Vercheres, partial reconstruction of wharf, $4,700; Woburn, repairs to wharf, $1,500; Yamaska, reconstruction of dam, $1,500; Yamaska, repairs to dam across Little Channel, $750.

Collingwood, Ont.—The wooden steamer Windsor was successfully launched at Robert Morrill's shipyard here recently. The ship is being built for the Ontario Gravel & Freighting Co., Windsor, Ont., and has the following dimensions: Length, 105 feet; breadth, 23 feet, and depth 12 feet, while the motive power is fore and aft compound engines, supplied with steam from a Scotch boiler 12 feet by 13 feet, and carrying a working pressure of 155 pounds per sq. inch.

Vancouver, B.C.—J. J. Coughlan & Sons have received the names of five of the six 8,800-ton steel boats they are building for the British Government. Boat No. 2 is to be known as the "War Camp." No. 3 is to go by the name of "War Charger." "War Chariot" is the name to be applied to the fourth boat. "War Chief" is the title assigned to the fifth boat, while the sixth will go by the name of "War Noble." The first boat has not been named yet. Splendid progress is being made at the Coughlan yards, and it is expected that the first vessel will be launched in November. The boats will be the largest ever built in British Columbia, being 100 feet longer than the Princess boats of the C. P. R., and with ten feet more beam.

"Western Star" Raised. — The steel steamer Western Star of Buffalo, sunk in the fall of 1915, with seven thousand tons of coal, was successfully raised and towed to a sheltered bay near Little Current, Ont., on Sept. 16. The vessel lay in eighty feet of water at the stern. Capt. Alex. Cummings, Superintendent of the Great Lakes Wrecking Co., was in charge of the operations. He built a timber cofferdam from the deck of the boat to the surface of the water and then pumped same out. As soon as the ship cleared from the bottom, she was pushed farther ashore to avoid accident. The full operation progressed as arranged without an accident or mishap of any kind. The steamer was valued at $400,000 and was insured for $250,000. About twenty excursion boats visited the scene from adjacent towns. The president and vice-president of the Wrecking Co. were present. Capt. Alex. Cummings and his staff are receiving hearty congratulations on their success.



ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Wallace Downey, president of the Downey Shipbuilding Co., New York, and a native of Nova Scotia, was in Sydney, C.B., recently.

Captain J. D. Warren, pioneer sealer of Victoria, B.C., and owner of the S.S. Beaver, the first steamer to ply the Pacific, died in the above city on September 9, aged 80 years.

W. G. Ross, chairman of the Montreal Harbor Commission was re-elected president of the American Port Authorities at the convention held in Cleveland last wek.

Aemilius Jarvis, of Toronto, has been awarded the Special Service Decoration for his patriotic work since the outbreak of war. Mr. Jarvis placed his offices at 103 Bay Street at the disposal of the Admiralty to facilitate the return of British naval reservists, and followed this up with active participation in the recruiting campaign for men for all branches of the British navy. Lieut. "Bill" Jarvis, a son, lost his life at St. Julien; a second son is a member of the C.E.F. The only other decoration of this order conferred upon a Canadian was awarded to Sir John Eaton, whose patriotic efforts are well known.

Alexander MacGregor, R.N.R., representative in Halifax of the London Salvage Association, died suddenly on September 13. Considered a high authority on steamship construction in Canada, Mr. MacGregor has since the commencement of the war been the means of saving much tonnage. Within the past month he brought safely into Halifax two steamships which had gone ashore on the Magdalens, and in addition to these had to his credit the saving of the Matatua, which sank at her dock in St. John, and the Clematis and Lord Antrim, which were ashore in dangerous positions on the Cape Breton coast. Mr. MacGregor was sent as guarantee engineer for the steamships built on the Cylde for the Boston and Yarmouth steamship service, and was engaged by that company as their marine superintendent. Later he was with the C.P.R., and at the outbreak of the war was in Scotland, superintending the building of monitors for the British Admiralty. His relatives are all on the other side of the Atlantic.

LICENSED PILOTS

ST. LAWRENCE RIVER

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

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Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

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J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

"The Collingwood Steamship Co." is the name of an organization which has been formed in Collingwood, Ont., to carry on a steamship service between Collingwood and Sault Ste. Marie, Ont. Capt. G. C. Coles is the president of the new company; M. P. Byenes is vice-president; Harry Storey, secretary; J. F. Zimmerman, treasurer, and Capt. F. G. Moles, manager. The steamer City of Meaford has been secured, and will be put into commission at once.

To Protect Shipyards.—Precautionary measures, designed to protect ships under construction in Canadian shipyards, have been taken by an Order-in-Council. This provides that it shall not be lawful for any owner of a ship, ship's agent, ship broker, who is not a natural-born British subject, to enter or to be upon any shipbuilding premises without the permission in writing of the Minister of Marine and Fisheries. The penalty is a fine not exceeding $500.

Toronto Harbor Improvements.—The work of the Toronto Harbor Board for 1917 and 1918 is being confined solely to revenue-producing land in the Ashbridge's Bay harbor industrial area and the inner waterfront. Two hundred and fifty-seven acres have been filled in the former district and 160 acres are now under lease. This is valued at from $2,000 to $3,000 an acre. Next year the commission intend to fill in about 150 additional acres, so that an asset worth at least about $3,000,000 will be produced by a portion of the $2,000,000 proposed to be expended next year. In addition to the 257 acres already reclaimed, there are 343 acres partially reclaimed. Work has been proceeding on the ship canal, and when the walls of this are complete, filling operations adjacent to it may be carried on. Work is now proceeding on the ship canal in the Ashbridge's Bay area. This runs from the Toronto Bay, north of the eastern gap, 7,500 feet east, and is 400 feet wide. Of the 16,400 feet of wall required 10,000 feet has been constructed.

1917 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G.-Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand,	93 Fifth Avenue, Lachine, P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	176 King Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross.	36 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

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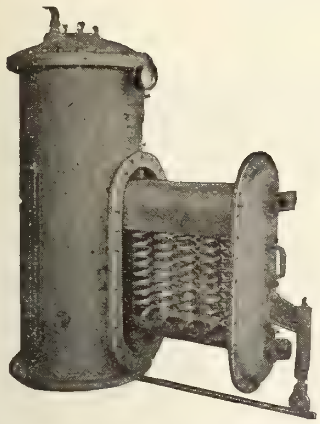
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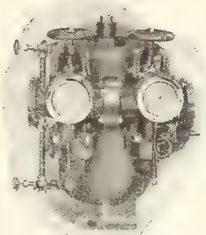
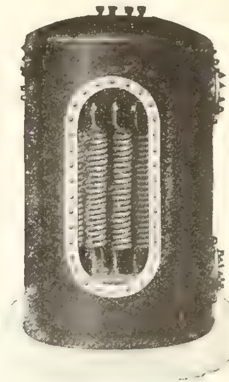

Reilly Multi-screen Feed Water Filter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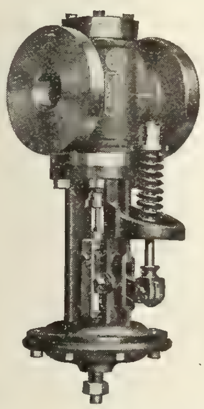
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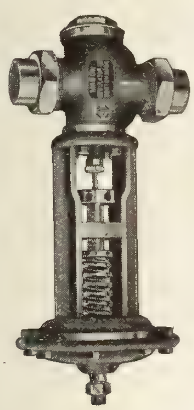
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A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World.

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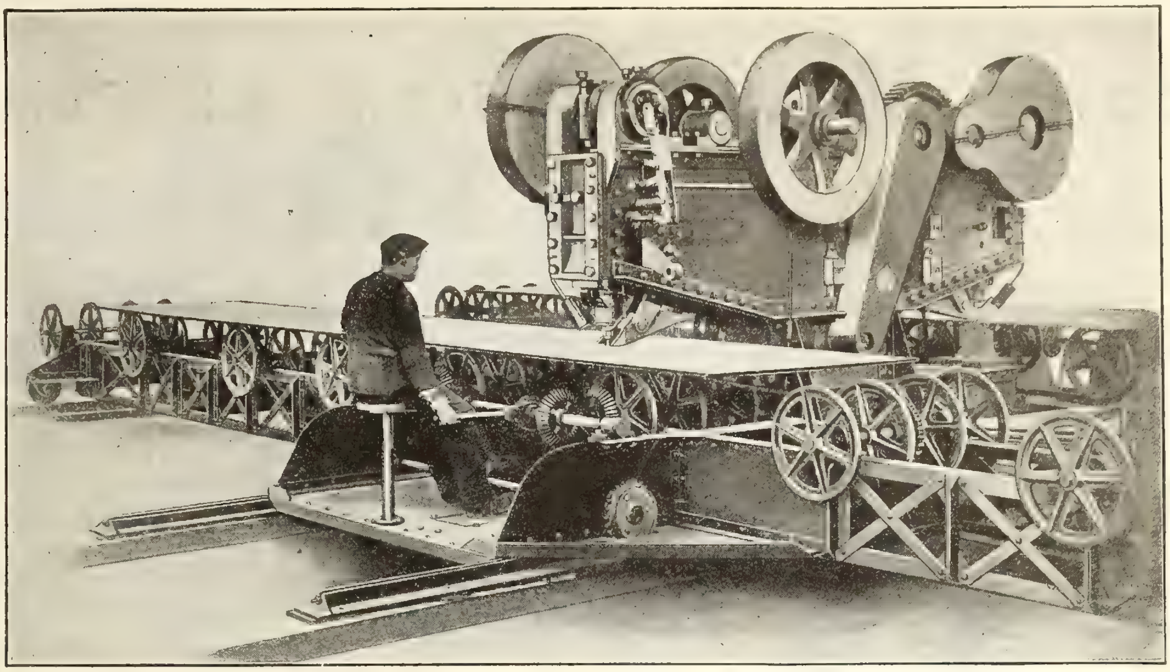

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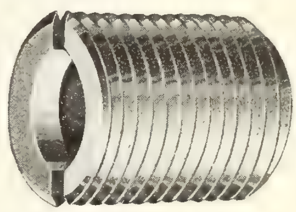

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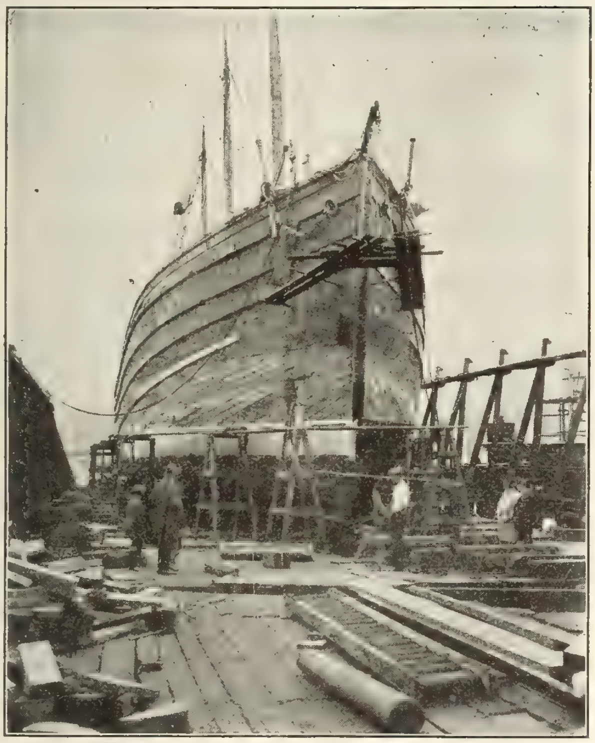

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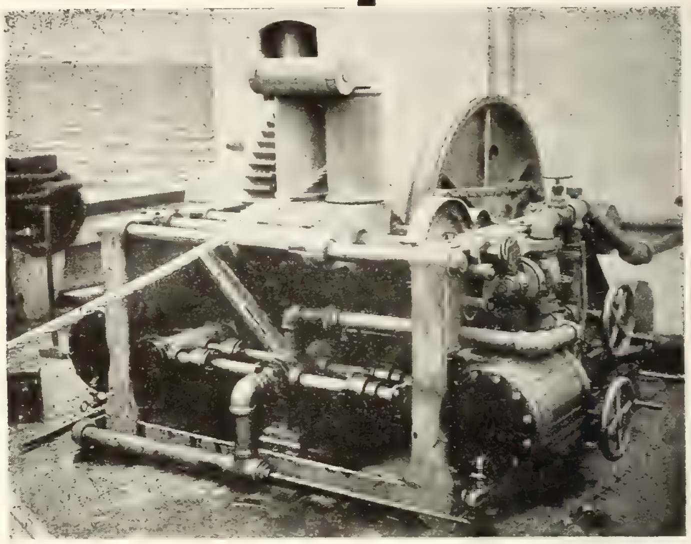

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Messrs. Corbet Foundry & Machine Co., Ltd.,
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Dear Sirs:—

We are in receipt of your letter of 15th regarding a reference concerning the No. 3 Automatic Steam Towing Machine which you installed on our S.S. "Imperial." We referred the matter to the Captain of the Imperial, and have received a reply as follows: "The Corbet Automatic Steam Towing Machine is giving good satisfaction, and as for improvements, I can't suggest any."

THE IMPERIAL OIL CO., LTD.,
Per R. W. Henderson.

Corbet Foundry and Machine Co., Ltd.,
Vancouver, B.C.
Dear Sir,—

As Engineer of the above vessel, I have no doubt but that you will be wondering about our Towing Machine, and would like a little information on same.

Everything about the Towing Machine has come up to the maker's statement, and as far as I can see satisfaction is fully assured. We gave the machine as severe a test last trip as ever will be put on it on board the tug "Ivanhoe," by towing a crib, One Million Four Hundred Thousand feet of logs, from Turner Island to Powell River, towing on the break only until we reached the "Euciltaw Rapids," when we put the Automatic control in operation, and it was a treat to see how easily the cable paid out when the extra strain came on it, the engine regaining control, as the Automatic Valve opened and hove in the cable, that had been paid out without any apparent effort.

We were handling the exhaust from the machine in the Condenser and no variation was noticeable on the "Vacuum Gage" at any time. The only change noticeable about the Condenser was a few degrees increased temperature on the Hot Well, and I am sure that with a reasonably clean condenser you are quite safe to recommend any one who purchases a machine to have its exhaust lead to the Condenser. As far as the "Ivanhoe" is concerned no trouble has been experienced by doing so. We are handling the exhaust in our Condenser all the time with a 2½" Duplex Donkey Pump, which I have found adequate to condense the exhaust steam.

Any further information will be gladly supplied.

Yours fraternally,
THE KINGCOME NAVIGATION CO.,
Powell River, B.C., Canada
Per Robt. Brown, Chief Engineer

The Corbet Foundry & Machine Co.

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Owen Sound - - Ontario - - Canada

The foregoing are but two of many testimonials supplied by our customers. Write for the others and some interesting data about the Corbet Towing Machine.

Mason Regulator and Engineering Co.

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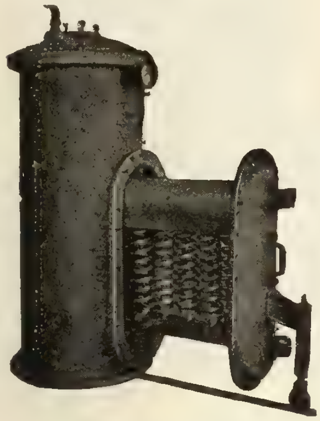

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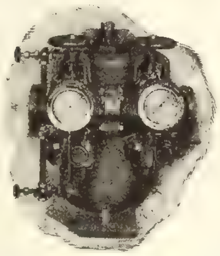

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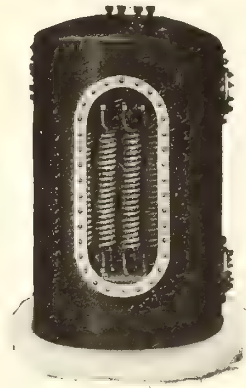

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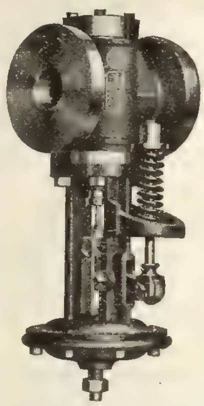

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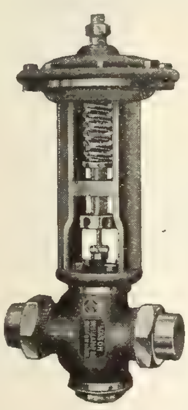

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The Publisher's Page

TORONTO October, 1917

Canada and Shipbuilding

THREE years ago Canada was grappling with the thousand and one problems of shell making. One by one the obstacles were overcome until to-day the business of making shells has been reduced to a fine science.

Canadian manufacturers and engineers are now tackling an even bigger proposition—that of shipbuilding on a large scale. The keel of a big and we hope a permanent industry has been laid.

A vast amount of credit is due those men who have courageously taken the rough material at hand and who are moulding it into a big and vital force in the present conflict. These men have their critics. Such men always have. In the present emergency, however, we are more prone to consider what has been accomplished rather than what has not been achieved or what has perhaps been imperfectly done.

Unlike the munitions business we are hopeful that the building of ships may become a permanent industry. It is true the British yards have many advantages over the Canadian but we cannot lose sight of the fact that it will take many years to replace the wastage caused by the Kaiser and his children, the U-Boats. One of these universally hated contrivances will destroy in five minutes the labor of months. They will have many five minutes in which to practice their devilish business, and we look for a period of protracted prosperity in shipbuilding circles in this country.

It is the purpose and sincere endeavor of this publication to keep abreast of the development and to report it for the benefit of our ever-increasing body of readers—the shipbuilders, ship owners and operators, naval architects and engineers. We invite correspondence upon any subject and we shall be glad to render any special service that we may be able to perform.

Our Editor, Peter Bain, M.E., received his early training in some of the largest plants on the Clyde and has been and is closely in touch with both British and Canadian shipbuilders. We would like our readers to feel that his knowledge of marine matters generally and his experience in shipbuilding in particular are at their disposal as is also the whole organization and facilities of the MacLean Publishing Company, Limited (Publishers of fourteen trade and technical and financial journals and magazines).

THE PUBLISHERS

Development of Ocean Service Shipbuilding in Canada-VIII.

By C. T. R.

In addition to the widespread requisitioning of vessels for transportation purposes by the Allies, the war attendant and normal merchant ship losses and the many months' almost complete cessation of new construction on the part of the latter, the merchant marine of the world has had the misfortune to become to a large extent the target for enemy submarine activity. All nations have suffered in this respect, hence the almost feverish anxiety being displayed by shipping interests to have the losses made good at the earliest possible moment.

WITH the possible exception of munitions making, no other industry in the past decade or more has evidenced such rapid and widespread development as has shipbuilding, particularly for ocean service. Canada is involved in the abnormal activity arising therefrom, both wood and steel construction being prominent in the list of vessels under contract in her shipyards. The enormous demand for steel for munitions purposes has been an important factor in the revival of wood shipbuilding, and needless to say will act as a powerful stimulant while the war lasts.

It will be apparent from a study of the chart on page 230, which shows the number and total register tonnage of vessels built in Canada since 1874, that our shipbuilding had not only become decadent, but had reached a stage in the year 1886 from which, with the exception of the years 1890 and 1891, it seemed just as impossible for it to get worse as to get better. Needless to say, there was more or less reason for the changed condition; further, the remedy was largely outside of and beyond the control of those responsible for maintaining the constructional activity of the then existing plants. Steel had begun to displace wood in naval architecture, except perhaps in the case of quite small craft, and naturally our shipyards were placed at a disadvantage, to wit, their equipment was altogether foreign to the handling of the new material. Besides, the latter was neither readily nor in quantity available. Wood shipbuilding in consequence languished as a commercial proposition, and while in the last quarter century steel shipbuilding has taken a foothold within our borders and has endeavored to find expression in steady growth and development, it must be admited that until this wartime, and particularly the past year or eighteen months, little evidence of worthwhile progress has been apparent. In new construction, both the cost of labor and material have militated against headway being made, Great Britain with her lower labor cost and ready-at-hand material being a formidable and uniformly successful competitor, irrespective of class ship.

OIL TANKER "REGINOLITE," BUILT AND ENGINED BY THE COLLINGWOOD SHIPBUILDING CO., ON HER TRIAL TRIP.

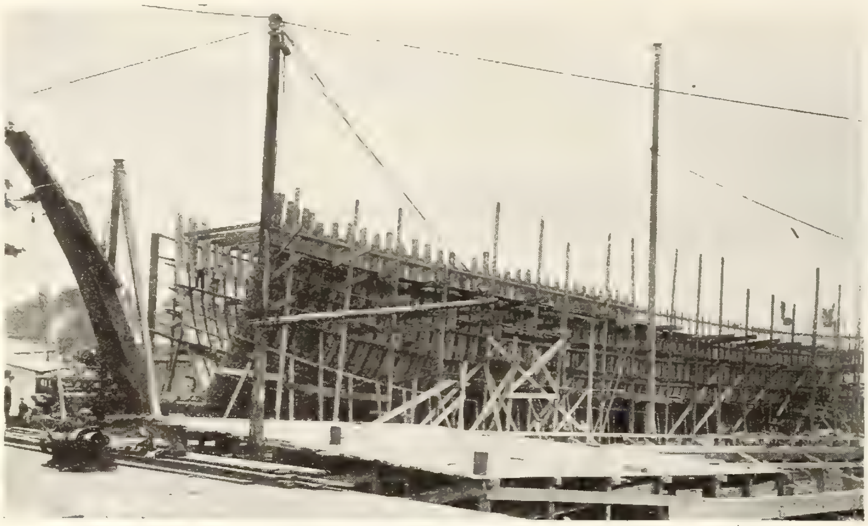
Arising out of the exigencies of the situation created by enemy undersea boat activities and the large measure of success resulting therefrom, nothing is being left to chance. Every effort is being concentrated and every facility is being requisitioned, utilized and provided, by Britain and her Allies to procure and intensify vessel construction to such a degree that the replacement of sinkings will be readily and continuously maintained and the futility of her persistence in submarine terrorism demonstrated to Germany.

The devastating character of this colossal war and the magnitude of the effort required for its successful prosecution have unearthed and necessitated the consideration of many vital problems, the solution of which calls for the skill and concentration of every department of commercial and industrial enterprise. During the first two years of hostilities, the essential need was unmistakably that of men and munitions, but the events of the past nine months or more have demonstrated that the most vulnerable point in our offensive might well be the abnormal loss of our ocean tonnage, because reducing if not wholly checking its effectiveness. The possibility of such a contingency has been fully realized for some time. As a

result, plans have been matured and given practical exemplification to offset any such disaster; hence a shipbuilding and marine engineering organization and activity without parallel in the industrial history of the world.

The construction of wood vessels, an industry that had almost become a lost art, will go on record as not the least among the notable developments of these strenuous times. The length of time that it formerly took to build such craft was, and still may be reckoned as, an undesirable feature whether in an emergency or otherwise. The past, present, and immediate future outlook for steel construction materials, offering little prospect of relief, however, at least in anything like the quantity desired, together with the growing urgency for "bottoms," constituted an argument in favor of wood construction as supplement to the other that could not well be passed up. Again, scarcity of experienced ship carpenters—those of the period a generation or more back—compelled attention by those directly concerned in ship production to be given such matters as standardization, and even to new materials of construction, the ultimate aim being rapidity of output, consonant, of course, with quality and efficiency, in transportation service.

It is not surprising, therefore, to find that considerable interest is being centred on concrete ship construction, and that not a few vessels of various dimensions and tonnage are at present being built.



AUXILIARY POWERED WOOD SCHOONERS UNDER CONSTRUCTION IN BRITISH COLUMBIA.

Whether the scope of service of such craft will attain to worth-while, or steel ship competitive, importance is meantime problematical; however, the odds are all against such an eventuality for a number of reasons. Their construction is expressive of the spirit of the times, and those responsible for the enterprise merit the greatest possible measure of success. The following particulars of a self-propelling concrete ship being built on the south shore of the Lachine Canal, at Montreal, for demonstration purposes, will, together with the illustrations on opposite page, enable a fairly intelligent idea to be formed of the detail and general features.

Length over all, 125 ft.; beam, 22 ft.; height from keel to main deck, about 13 ft.; draft loaded, approximately, 9 ft.

The steel framework consists of fabricated ribs of angle bar diagonals, five inches at the upper ends and gradually widening to a depth of 14 inches where they pass through the center keelson. They are set at 27 inches apart throughout the entire length of the vessel. In addition to the main keel, which has an approximate cross sectional area of 220 square inches, there are two sister keelsons located midway between the center keel and the bilge keelson, these latter as well as the sister keelsons having a cross sectional area of about 144 square inches. All these members are suitably reinforced with longitudinal steel bars wired to the cross ribs. The bow and the stern posts are a continuation of the central keelson, the outer portion of the bow being provided with a heavy angle irin, for a cutwater.

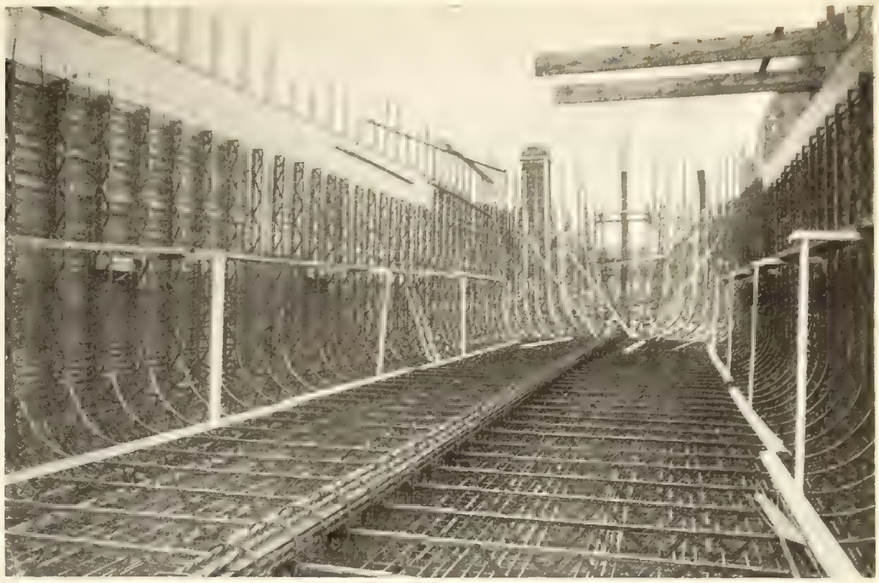
After the ribs were placed in position, the outer form was built up from the main platform which supports the entire structure. This platform rests upon a large number of 6-inch hardwood rollers, which in turn rest upon heavy timbers sunk in the ground, the idea being to facilitate the launching, the exact procedure for which has not yet been de-

WOOD SHIP BEING CONSTRUCTED ON ISLAND OF ORLEANS, BY THE QUEBEC SHIPBUILDING & REPAIR CO. LENGTH, 223 FT.; BEAM, 41 FT. 8 INS.; DEPTH, 25 FT.; CAPACITY, 2,100 TONS.

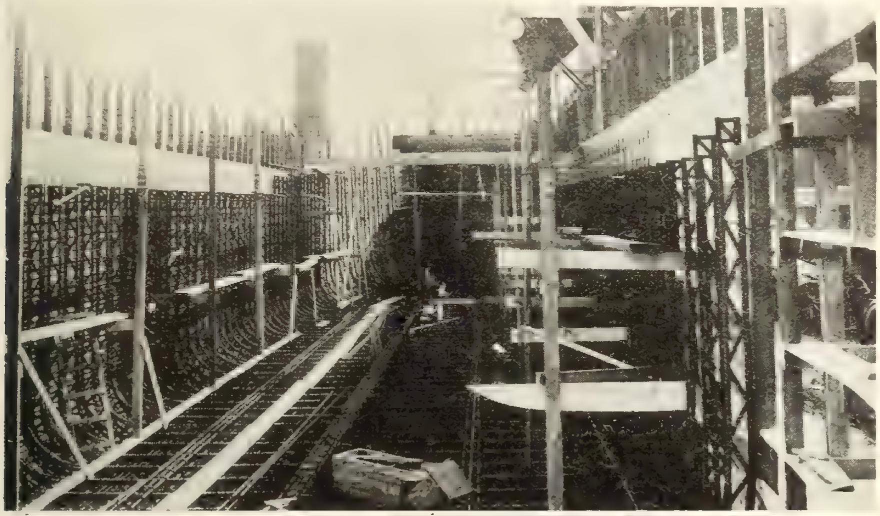
cided. After the placing of the inner forms, the concrete was poured by means of the hopper and shoot shown in one of the illustrations, the concrete being distributed to the various sections by hand. The thickness of the concrete between the ribs runs from 3 inches above the deck to a thickness of about 5 inches on the bottom of the hull, the approximate dimensions of the reinforced ribs being 30 square inches at the top to about 75 square inches where they join the center keelson.

The vessel will be equipped with a 150 horsepower, single screw type marine steam engine, set upon a concrete foundation and located close to the stern. This has been chosen to minimize vibration and also to provide additional cargo space. The tube for the propeller shaft, the tube for the rudder shaft, together with all tubes for hawsers, etc., are embedded in the concrete hull.

Some conception of the possibilities and advantages that lie before this particular class of ship construction, if the same should prove successful in service, may be gathered from the fact that the work of laying the foundation beams was started on August 15 of this year, and it is expected that the vessel will be launched early in November. The pouring of the concrete from the keel to a point above the water line was accomplished in about 48 hours, and the remainder of the hull to the top of the freeboard in a little less time. Owing to the nature of the work it was necessary to pour continuously so as to avoid the possibility of defects in the structure. This vessel will be capable of making about eight miles an hour, and will have a displacement of approximately 400 tons (light). The plans were prepared by C. M. Morssen, C.E., and Prof. E. Brown, of Montreal.



CONCRETE SHIPBUILDING AT MONTREAL, SHOWING REINFORCEMENT DETAIL.

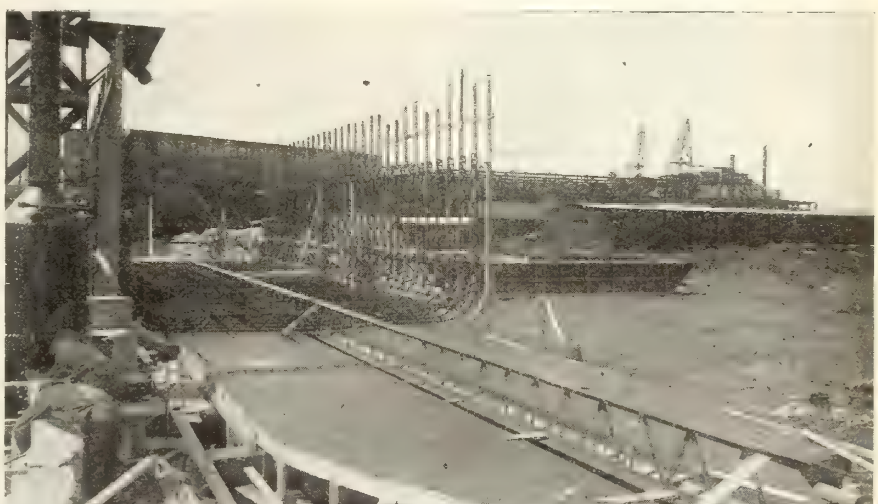


CONCRETE SHIPBUILDING AT MONTREAL, SHOWING FORWARD PORTION OF OUTSIDE FORM IN POSITION.

FERRO-CONCRETE SHIP CONSTRUCTION

THE Committee of Lloyd's Register of Shipping have recently approved plans for the construction of a number of non-propelling barges, some of them designed to carry 500 tons deadweight, and also of a motor vessel, to be built of ferro-concrete in the United Kingdom and in Norway for the British and Scandinavian coastal trades. These vessels will be built under the inspection of the society's surveyors with a view to classification in Lloyd's Register Book. Plans of other ferro-concrete vessels of larger carrying capacity for certain sea trades are at present under consideration.

In this connection it may be mentioned that one of the society's principal surveyors has recently made a tour of inspection in Scandinavia, where, owing to circumstances arising from the war and other causes, the use of the ferro-concrete system of ship construction has so far been most developed. The report of this visit has naturally placed the Committee of Lloyd's Register in possession of most valuable data on the subject. The possibilities of ferro-concrete as a material for shipbuilding purposes are meantime arousing keen interest.



CONCRETE SHIPBUILDING AT MONTREAL, SHOWING STEEL REINFORCING FRAMES PARTLY ERECTED.

PACIFIC COAST DEVELOPMENTS

Featuring the Record of Progress and Dealing With the Steps Being Taken to Stimulate and Enlarge the Already Established Shipping and Shipbuilding Enterprises

JUDGMENT OF INTEREST TO SHIPPING MEN

PROBABLY no legal decision has been awaited with more interest than that handed down by the Hon. Mr. Justice Martin in the Exchequer Court of Canada in Admiralty, in the case of the collision between the tug Cleeve and the G. T. P. steamship Prince Rupert, in which His Lordship holds the Rupert responsible for the accident. The case was tried by a Marine Court in Victoria presided over by Capt. J. D. Macpherson, wreck commissioner for British Columbia, which decided in favor of the G. T. P. vessel. In the second trial by a Marine Court, presided over by Capt. Eddie, examiner of masters' and mates' certificates, at Vancouver, the steamer Prince Rupert was held to blame. In the opinion of the legal fraternity, says the Victoria Colonist, the judgment is one of Dominion-wide importance. The history of the case is given in His Lordship's judgment, which reads in full as follows:

The Judgment

This action arises out of a collision in Vancouver Harbor on the 28th of December last at about 3.45 p.m., when the high-powered SS. Prince Rupert (Duncan McKenzie, master), 320 feet in length, gross tonnage 3,379, registered 1,626, speed 18 knots, collided with the steam tug Cleeve (W. N. Coughlin, master), length 58 feet 6 inches, beam 15 feet, and caused considerable damage, her stern cutting into the Cleeve's port side about amidships.

Both vessels had entered the Narrows, the Cleeve in advance, and passed Brockton Point and Burnaby Shoal, having the last between them, with the Cleeve inside of it, the intention of the Prince Rupert being to make her landing at her owners' dock, the Grand Trunk Pacific; and that of the Cleeve to make the Hastings Saw Mill wharf, a short distance beyond said dock.

It will thus be seen that their intentions, if carried out, would, having regard to the short distance to be traveled, sooner or later, result in converging or intersecting courses, dependent upon the rate of speed of the respective vessels.

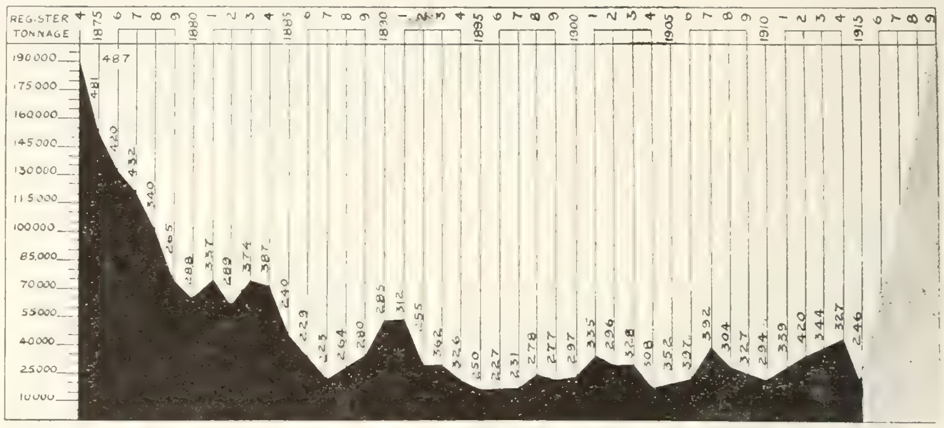


CHART SHOWING NEW VESSELS BUILT AND REGISTERED IN THE DOMINION OF CANADA DURING THE PERIOD ENDED DECEMBER 31 OF EACH YEAR FROM 1874 TO 1915, INCLUSIVE. THE SHADED PORTION TO THE RIGHT INDICATES THE ANTICIPATIONS FOR 1917-18-19.

A Strange Occurrence

The evidence is in certain important respects contradictory, but after an unusually careful consideration of it (necessitated by the fact that there is here the strange occurrence of a collision in broad daylight on a clear, calm day in a harbor), I find as a fact that the Cleeve's straight course was kept at a speed of about six knots from Burnaby Shoal towards her said destination, and that it was not varied till "in the agony of an impending collision."

Position of Vessels

At one time the Prince Rupert was admittedly as regards the Cleeve an overtaking vessel, up to, at least, when abeam of Burnaby Shoal at 3.37 p.m., and after she, the Prince Rupert, changed her course, after passing said shoal to S.50 deg. E., and later to S.25 deg. E., to make a landing at said dock, she became a crossing, if not a still overtaking vessel, and in either case bound under Articles 19, 22, or 24, to keep out of the way of the Cleeve, which she had, I find, on her starboard side, and in such case there was under Article 21 the corelative duty cast upon the Cleeve to "keep her course and speed," which duty I find she discharged.

I am unable to take the view that the stopping of the Prince Rupert's engines and her slowing down on encountering the North Vancouver Ferry changed her character as regards the Cleeve or lessened her obligations: it seems to me that relying on the fact that she was at half-speed, going 6—8 knots after passing the shoal, she either thought she could ignore the Cleeve and would have time to make her landing before the Cleeve's

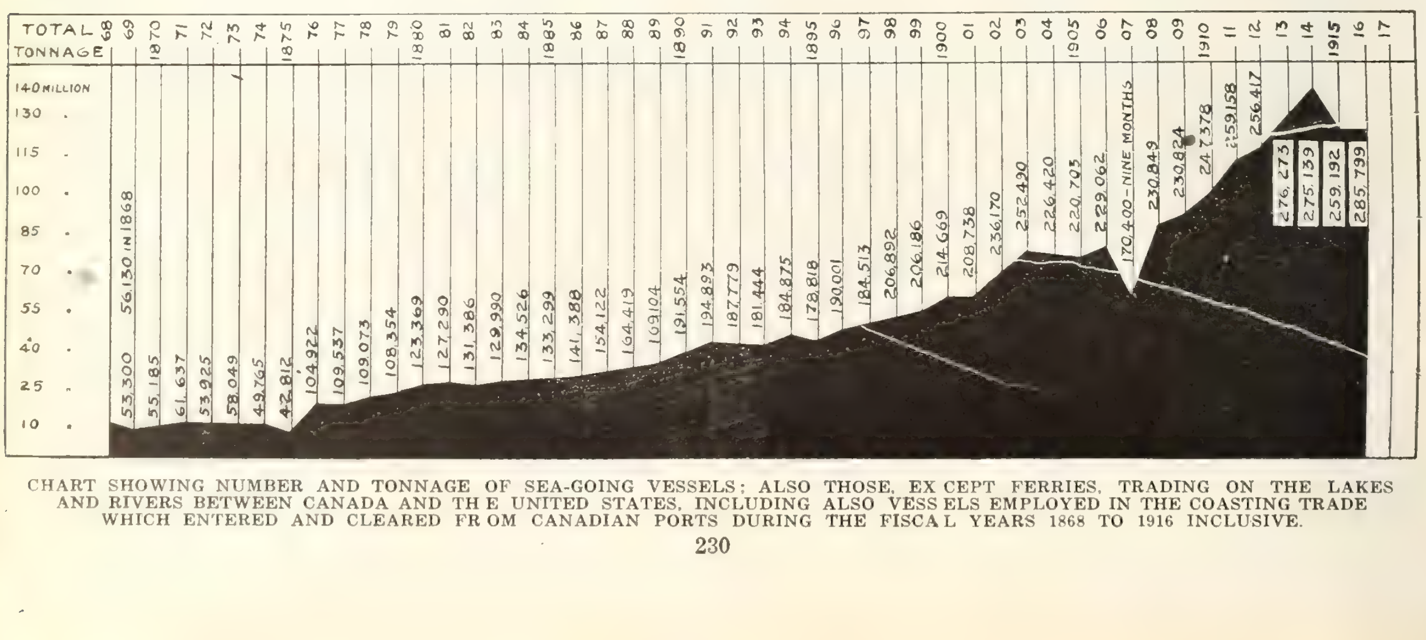
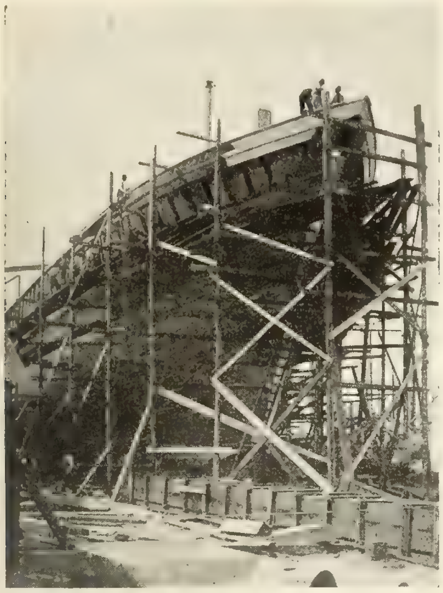


CHART SHOWING NUMBER AND TONNAGE OF SEA-GOING VESSELS; ALSO THOSE, EXCEPT FERRIES, TRADING ON THE LAKES AND RIVERS BETWEEN CANADA AND THE UNITED STATES, INCLUDING ALSO VESSELS EMPLOYED IN THE COASTING TRADE WHICH ENTERED AND CLEARED FROM CANADIAN PORTS DURING THE FISCAL YEARS 1868 TO 1916 INCLUSIVE.

course intersected, or else she dismissed the Cleeve entirely from her mind on the erroneous and improper assumption that



WOOD SHIP UNDER CONSTRUCTION IN BRITISH COLUMBIA YARD.

she was only going so far as the Canadian Pacific Railway Company's Australian wharf, a long way short of the G. T. P. dock, or up Coal Harbor, which latter view is supported by the evidence of her first mate, Roderick Mackenzie.

No Proper Lookout

From either point of view, this in the circumstances was a "neglect to keep a proper look-out," as required by the "good seamanship," Article 29, and it was not taking proper "precaution" to speculate upon and miscalculate the speed of the Cleeve, especially in ignorance of her destination. These misapprehensions as to speed and relative conditions lead to serious consequences, as pointed out by the Lord Chancellor in The Olympic v. The Hawke, in fra.

Requires Precaution

In my opinion the making of the landing along the waterfront of a busy and important harbor is a manoeuvre which ought to be accompanied by full precautions, the first of which is an adequate lookout. I draw attention to my observations upon the "proper precaution" of keeping "a general lookout" in Vancouver Narrows, in Bryce v. Canadian Pacific Railway Company (1907), 13 B. C. 96 at 101, which view was affirmed by Their Lordships of the Privy Council, as reported in 15 B. C. 510 at 512-3, wherein Their Lordships said of the master of the Chehalis:

"The real cause of this unfortunate collision was that there was no adequate lookout kept on board the Chehalis. . . . It seems almost incomprehensible that he should not have noticed her (the Princess Victoria) even before she rounded, and as she was rounding the (Brockton) Point, unless he never looked anywhere except straight ahead of his vessel."

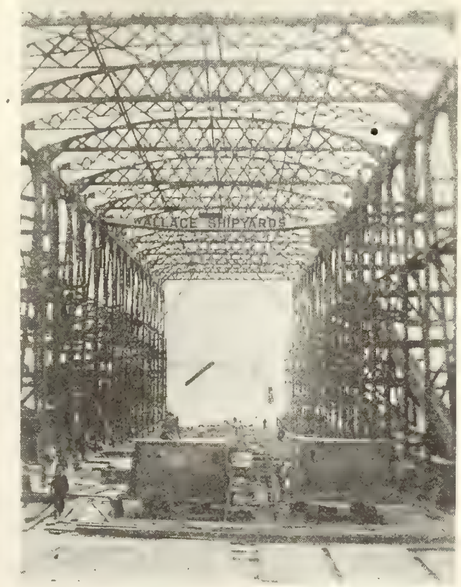
Attention Engrossed

These observations are, in my opinion, very appropriate to the circumstances of the case at the bar, and I also refer to those in Caldwell v. The C. F. Bielman (1906) 10 Ex. 155. I think that the attention of the Prince Rupert was, after passing the shoal, so engrossed upon the ferry that she became "strangely oblivious of the presence of the" Cleeve —to adopt the language of Their Lordships of the Privy Council in The Albino v. The Allan Line SS. Company and The Parisian (1907) 76 L. U. P. C., 33, 34.

So far as the Cleeve is concerned, while her master had been aware for some little time of the presence and approach of the Prince Rupert, yet it was his duty to obey Article 21, and "keep his course and speed," and he was justified, in his position, in assuming that the Rupert would conform to Article 19, and keep out of his way, and he properly persisted in this line of conduct till the Rupert was upon him, when, "in the agony of an impending collision," he tried ineffectually to escape from it by going astern and putting his helm to starboard, and though it was too late, yet no blame clearly can be attached to him for the failure of these final efforts.

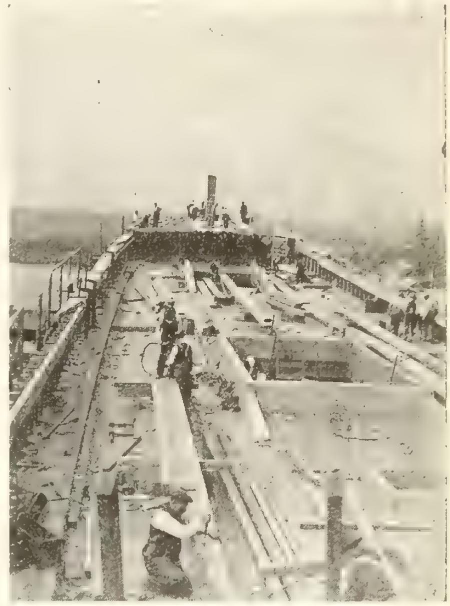
Cleeve's Position

It was suggested that the Cleeve might have avoided the accident if she had earlier altered her helm, but the cases show that it imposes a serious burden upon a vessel if she fails to conform to Article 21, and she lays herself open to attack by the "give-way" vessel by departing from its directions, and must be prepared to justify that departure by the proper execution of nautical manoeuvres, such as in dropping a pilot,



STEEL SHIPBUILDING BERTH, WALLACE SHIPYARD, N. VANCOUVER, B.C.

or approaching a landing, or to lessen the consequences of collision, to save life, or otherwise. See the late case of The Fancy (1916), 86 L. J. P., 38; and The Echo (1917) Ib., 121, on the point; and also those of The Velocity (1869), 39 L. J. Adm., 20; L. R. 3 P. C. 44; The



DECK VIEW OF WOOD SHIP UNDER CONSTRUCTION IN BRITISH COLUMBIA YARD.

Arranmore v. Rudolph et al (1906), 38 S. C. 177 IX.; The Albano v. The Allan Line SS. Company and The Parisian, supra; The Roanoke (1908), 77 L. P. P., 155; and The Olympic v. The Hawke (1914), 12 Asp. 580; 84 L. J. P. 49.

A Difficult Matter

In the Albano-Parisian case, Their Lordships said, p. 40:

"It must always be a matter of some difficulty for the master of a vessel which has to keep her course and speed with regard to another vessel which has to keep out of her way, to determine when the time has arrived for him to take action, for if he act too soon he may disconcert any action which the other vessel may be about to take to avoid his vessel, and might be blamed for so doing, and yet the time may come at which he must take action. Therefore he must keep his course and speed up to some point, and then act," but the precise point must necessarily be difficult to determine, and some little latitude has to be allowed to the master in determining this."

Applying this language to the case at bar, I determine that the master of the Cleeve kept his course and speed up to a proper point, and that the accident is solely attributable to the negligence of the Prince Rupert in failing to comply with the articles above cited.

The prior judgments of this court in The Cutch (1893) 2 B. C. 357, and Smith v. The Empress of Japan (1901) 8 B. C. 122, confirm in general the conclusions I have arrived at.

Therefore, let judgment be entered in favor of the plaintiff, with costs, and if necessary there will be a reference to the Registrar, with merchants, to assess the damages.

SHIPBUILDING IN BRITISH COLUMBIA

IT was in 1788 that the first wooden schooner was built in the province of British Columbia, construction taking place at Nootka Sound. It is just over 238 years ago since the first vessel was built in Canada, a schooner called the Le Grifon being started in the East on August 8, 1679. From the foundation of that "sorry contrivance" of rushes and dried grass, the shipbuilding industry in British Columbia raised itself up to the building of one wooden schooner a hundred and twenty-nine years ago. Now the value of the industry is about $27,000,000, says the Vancouver Daily Province.

As Vancouver and Victoria grew up, the business of building ships grew with them and many of the coasting vessels that ply around the shores of the province were built locally. The industry as might be expected suffered reverses, for little more than a year ago there were no ships under construction or contracted for. When the demand for ships increased, however, British Columbia's advantages for the building of vessels asserted themselves and contracts were soon being let. A further impetus came not long ago with the announcement by the Imperial Munitions Board of a programme involving an expenditure of about $9,000,000.

Large Contracts Placed

The Coughlan Shipyards on False Creek in Vancouver have a programme of construction involving about $7,500,000, by far the largest of any yards in the province. Six steel steamers of 8,800 tons dead weight will be built. Three are being constructed at the same time. Five of the ships are for British interests, while one is for Norwegian buyers; the value of each ship is approximately $1,250,000.

The new Lyall yard at North Vancouver, formerly No. 2 shipyard of the Wallace Shipyards, Ltd., has a programme of six steamers for the Imperial Munitions Board. Construction work is being started and as the vessels will be worth about $350,000 each, the value of the programme will be about $4,500,000.

Of about the same value is the shipbuilding programme of the Western Canada Shipyards, which have recently been opened in Vancouver, situated on False Creek. They will build six wooden steamers for the Imperial Munitions Board, two having been started, their total approximate value $4,500,000.

The Wallace Shipyards at North Vancouver started the present activity in shipbuilding on that part of the coast. The original programme called for the construction of six auxiliary power schooners, valued at $150,000 apiece for the Canada West Coast Navigation Co. Four are finished. Later on a contract was let for another similar vessel to be built for the Dominion Government for service between the Atlantic and the Pacific. Then arrangements were made to build three steel steamers, the first of which has already sailed and the second of which is now under construction. These steel vessels are worth about $650,000 each, bringing the entire value of the Wallace shipbuilding programme to about $3,000,000.

Other Work in Progress

The Cameron-Genoa Shipyards at Victoria will build four wooden steamers for the Imperial Munitions Board, at a total value of about $1,400,000. They are also building six auxiliary schooners for the Canada West Coast Navigation Co., at about $150,000 apiece, of which four have been launched. The total value of the Cameron-Genoa programme of marine construction is about $2,300,000.

Five ships for the Imperial Munitions Board is the programme of the Foundation Company which has leased Turpell's old yard at Victoria Harbor.

They will be worth about $1,750,000.

The British Pacific Engineering Company of Vancouver have a construction programme of about $1,500,000.

Four steamers for the Imperial Munitions Board will be constructed by the B.C. Construction & Engineering Co. which is establishing shipyards on Poplar Island, near New Westminster. The total value of the vessels will be about $1,400,000.

The Coquitlam Shipbuilding Co. yard at Coquitlam was taken over by the Pacific Construction Co. and they will build two wooden steamers there for the Imperial Munitions Board at a total cost of about $700,000.

Harrison & Lamond at South Vancouver are building an auxiliary schooner for the Dominion Government for service between the Atlantic and Pacific. She will be worth about $150,000.

The Taylor Engineering Co. of Vancouver, which has taken up the designing of ships as well as their building, is constructing small ships of a total value of about $300,000.

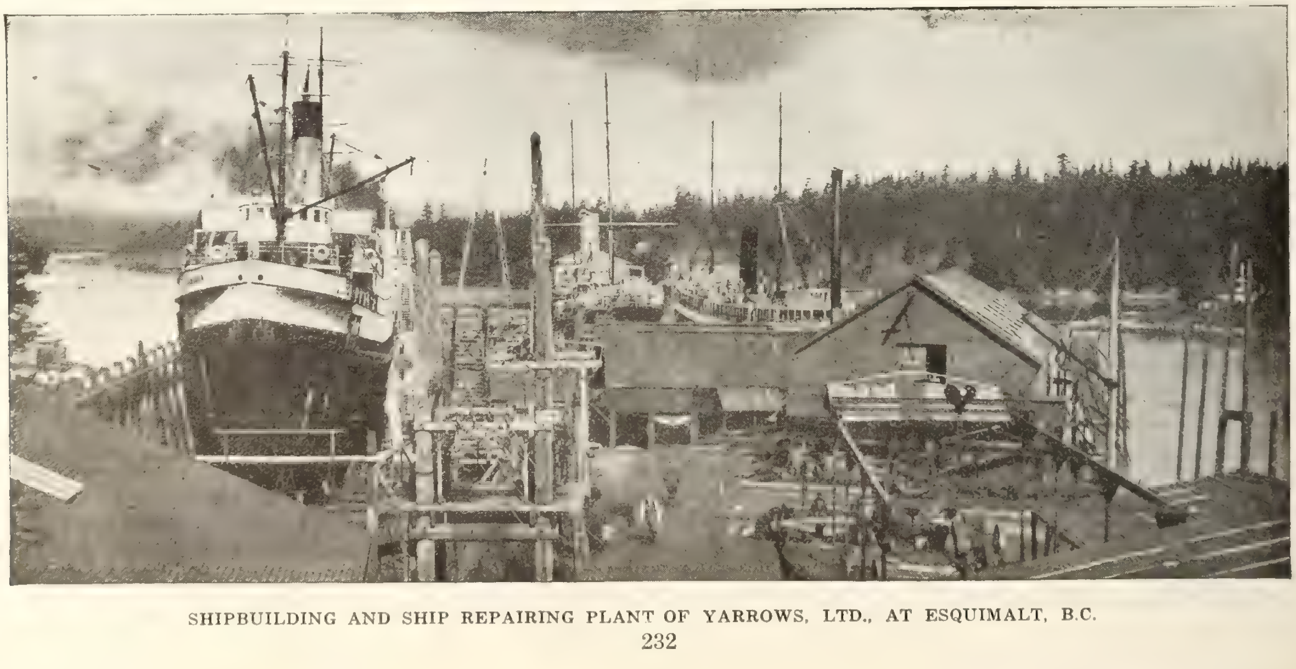
Yarrows Limited at Victoria are doing a considerable amount of repair work and are also building four shallow draught steamers for river navigation in India.

The Vancouver Shipyards have finished one cannery tender and another is being built. A new company known as the Vancouver Shipyards & Engine Works is locating its yard on the south shore of Burrard Inlet and will build ships for sale instead of on contract.

Among other concerns having shipbuilding plans are the B.C. Marine Ltd., the Sound Construction Co., the Victoria Machinery Depot and the Westminster Marine Ways. Other projects are rumored and it seems not unlikely that even concrete shipbuilding may take its place in British Columbia.

YARROWS LTD., ESQUIMALT, B.C.

IN January, 1914, Yarrow & Co., of Glasgow, extended their operations to Canada. Under the control of Norman Yarrow, the second son of A. F. Yarrow, the business of the British Colum-



SHIPBUILDING AND SHIP REPAIRING PLANT OF YARROWS, LTD., AT ESQUIMALT, B.C.

bia Marine Railway Co., established in 1893, was taken over, and the yard at Esquimalt, near Victoria, Vancouver Island, was set going for shipbuilding and marine repairing work. From a short article in a recent issue of the official organ of the Manufacturers' Association of British Columbia, we learn, says *The Engineer*, that great success has attended the operations of Yarrows, Ltd., as the Canadian branch is called.

At the present moment the yard, we gather, is occupied with a considerable amount of important naval work for the British Admiralty. Apart from this the new firm has already undertaken some notable shipbuilding contracts, and has executed a good quantity of repair work. Among the ships which it has built may be mentioned the Princess Beatrice, the Princess Royal, the Princess Maquinna, the tug Nanoose, and two large steel transfer barges, all for the Canadian Pacific Railway's coast service. For the Dominion Government it has constructed the hydrographic steamer Lillooet, and the quarantine steamer Madge. During the past year it has also built two sternwheel shallow draught vessels for service in India. Two more are at present under construction. These vessels are 132 ft. long with a beam of 32 ft., and a moulded depth of 4 ft. 9 in.

Repair Work Feature

Among the repair work undertaken may be mentioned the case of a Grand Trunk Pacific Company's steamer that had been ashore. This vessel was repaired in the firm's dry dock. The work necessitated the renewal of practically the whole of the ship's bottom for a length of 180 ft., and required the fitting of 35 new plates. The passenger steamer Mariposa, belonging to the Alaska Steamship Co., after being wrecked and submerged had her interior completely rebuilt by the firm. The Canadian Pacific steamer Princess Mary was lengthened by 38 ft. A new fully laden cargo vessel of 8,800 tons, having been brought back from sea in a disabled condition, was fitted with a new 18 ft. bronze bladed propeller. The propeller was cast and fitted and the ship made ready for sea again within a week without docking or disturbing her cargo. The work was done by building a wooden cofferdam round the vessel's stern.

Propeller Manufacture

The firm has made a speciality of the manufacture of manganese bronze propeller blades and of the conversion of vessels from coal to oil burning. Among the work of the latter description recently undertaken, we may mention the cases of the cable steamer Restorer, several of the Canadian Pacific vessels, the coast fleet of the Grand Trunk Pacific, and various local dredgers. Important naval repair work has been executed for the Imperial, the Canadian, and the Japanese Governments, and at the present moment extensions are being carried out in the different departments to enable the yard to participate in the new shipbuilding programme recently undertaken in Canada by the Imperial Munitions Board.

The yard is situated at Esquimalt Harbor, and adjoins the site of the proposed Government dry dock. It covers an area of eight acres, and employs on the average about 250 hands. Its wharf exceeds 500 ft. in length and can accommodate on both sides vessels sent in for overhaul or repair. It is equipped with 60-ton shear legs and a ten-ton floating derrick. The building slip can be used for ships up to 300 ft. in length and 50 ft. in beam. Space is available for a second slip.

SINGLE DAVIT BOAT LAUNCHING GEAR

ATTENTION is drawn in a booklet issued by James Howden & Co., of Glasgow, to the Graham single davit for lowering lifeboats. With this the boat is suspended centrally to ensure raising and lowering on an even keel, the sling arrangement consisting of two rigid rods spread diagonally to take one-third of the boat, and securely bolted through the keel. At the upper end of each rod a short length of wire rope is attached to the ring which engages with the disengaging hook. This hook has its point so weighted and hinged that whenever the boat becomes water-borne and the tension of the load is removed the point falls automatically and instantly unships the ring and sling. The flexible top portion of the sling remains hanging from the rods, which are kept upright until the boat is clear of the ship's side, but can be made to lie along the thwarts by the simple withdrawal of a pin. To prevent oscillation of the boat while it is being loaded and lowered, the rods, when in use, are held in position by means of eye-plates fixed to the thwarts.

The operating gear is mounted on a self-contained steel derrick with chain gun-tackle purchase instead of manila, and is actuated through winch gearing by a pair of crank handles, though power can also be readily applied. Only two men, it is stated, are required for launching a 28 ft. lifeboat, instead of the 12 needed with double-stalk davits, the time occupied being half a minute. A self-sustaining screw-brake attached to the winch permits a boat to be lowered at any speed required under the control of a single man.

Among other advantages claimed for this type of davit are that it weighs less by at least 1,000 or 1,200 pounds than the usual davits; that it occupies less deck space, and by enabling boats to be placed more closely stem to stem permits more boats to be carried directly under davits at the ship's side than with the ordinary two-davit system.

Handling "Nested" Boats

Further, it is claimed to be admirably adapted for handling "nested" boats, since after one boat has been launched the empty block can be recovered ready for another at the rate of 60 ft. a minute without fear of the chain-fall twisting or the block capsizing.

RAPID UNLOADING AND PORT CHARGES

THE rapid clearance of ships in our ports is a matter of vital importance from the port point of view. The quay walls of a port are in general the most costly item of port equipment. The earning power of the port may, with advantage, be referred to the income derived per lineal foot of quay, and the cost of the port may be referred to the same unit.

Earning Power Per Quay Foot

The cost of the port per lineal foot of quay will include the capital expenditure on the quay walls, docks, roads, tramways, sheds, power and lighting appliances, and the outstanding capital cost for the dredging, lighting and buoying of the harbor. These represent a capital sum on which there is an annual charge for interest and sinking fund. To this must be added the annual expenditure on the maintenance and working expenses of the port, together with establishment charges. If the aggregate sum representing these annual charges is divided by the length in feet of the quay berths, we arrive at the annual expenditure on the port per lineal foot of berthage.

In a similar way, if we find out what the annual income of the port amounts to from dues on shipping and goods, rents, and other charges, and divide this sum total by the length of quay berthage in feet, we arrive at the earning power of the port per lineal foot of berthage. We are now in a position to say whether the port as a whole is solvent, or whether the port charges are sufficient or excessive. We arrive, in fact, at what the average earning power of each foot of quay should be.

Quay Earning Power Varies

In a detailed examination of different portions of the berthage on these lines it will be found that some quays pay much better than others; that in fact some quays are much more efficiently worked than other portions. It will generally be found that berths apportioned to fixed and regular trades yield a higher return than the open berths devoted to the general trade of the port. This naturally follows, because berthage is not appropriated to a particular trade unless that trade is regular and of sufficient volume to warrant an appropriation. This all points to the necessity of insisting on rapid discharge and clearance of ships at these open quays.

From the annual expenditure per lineal foot and the income per lineal foot of quay we can at once put our finger on the weak spot and say that such and such a quay must be worked at greater pressure. The importance of appliances for handling raw materials and merchandise immediately becomes evident. It is only by such appliances that you can ensure the rapid discharge of the ship, make your port financially sound, keep down port charges, and thus make your port attractive to both shipowners and traders.—Sir John Purser Griffiths in "James Forrest" Lecture before Institution of Civil Engineers.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

"CELIA"—"KATIE H" COLLISION

An investigation into the causes leading to the collision between the SS. Celia and the barge Katie H, near Isle a la Pierre in the River St. Lawrence on Aug. 3, was held at Montreal, Aug. 7, 8, and 18, before Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Capts. Francis Nash and Charles Lapierre.

"Celia" Master's Evidence

The master of the Celia, David M. Taggart, stated that his ship was steel built, single screw, triple expansion engine, of 3,285 tons net, 5,004 tons gross, carrying a crew of 40, with a speed of 9½ knots; that on this occasion he had come on the bridge six minutes before the impact; that he noticed a tow apparently one mile distant, at two points on the port bow; that the engines were put at standby then aport and hard to port helm were ordered, without corresponding signals of the whistle, then to prevent going ashore the engines were put full speed ahead, and a hard to starboard helm ordered and under that movement the last barge of the tow of two barges rubbed her quarter in the vicinity of the house of said barge, which is aft, against the port bow of the Celia; that the speed of the ship or tow were not stopped, nor inquiry made, each proceeding on.

He was sure that before the hard to port helm he had noticed the up range lights on Isle a la Pierre were, he thought, in line, but did not see the black buoy and therefore could not exactly give the exact spot of the collision, but marked a spot of the collision on the chart which he claims to be as near as possible the locality. He claims his vessel was so close to the land which he estimated to be 50 feet from the beach that the land beyond was hidden from view.

He did not interfere with the pilot, and had been on the river but once before and was not therefore acquainted with it. He avers that the tug and tow were on the port side of the mid channel line and when he ported the tug was about 300 to 400 feet distant.

Tug Master's Evidence

Captain Thibault of the tug J. H. Hackett averred that he holds a Canadian certificate and has been master of tugs for 11 years, that he has never had an accident before; that he left Sorel at 4.30 with the Katabdin and Katie H in tow; that he had come from Montreal, picking up the Katabdin at Sorel; that there were ten men on his vessel; that the mate, who has no certificate, was steering at the time of the accident; that the mate called his attention to a steamer coming up; that he was at the time writing a letter in the wheelhouse at the back of his son; that he told him to open the range lights about a fathom; that he was sure he was to the southward of the channel; that he took the wheel and ported, sending his son,—the mate,—aft to see everything was all right; that he was going through the water at about 6½ miles an hour, and had a two mile current with him; that he ported his helm; that the first barge did not swing immediately but caused, when it did so, the last barge to be out of line a little.

He stated that from the inside of the wheelhouse he made some signals with his arm towards the barkes but did not know if they were seen; that sometimes he uses the whistle to warn those on the barges but in this instance did not do so, but sent his mate aft; that he knew there was a north channel which was navigated by vessels of bigger draft, but he could not navigate it as he was not acquainted with it, and that between the two bargoes was 70 to 75 feet; that he did not see any one on the barges as could not see them from where he was.

He positively swears that he passed ten to twelve feet from buoy 127 L; at the time of the collision he starboarded to pass astern of the steamer; that he did not stop after the collision, proceeding on as he could not stop his vessel with a current with him and a tow.

He had seen the Celia a mile before he reached the buoy, and his idea is that the collision occurred 600 feet above buoy 127 L.

"Celia" Pilot's Evidence

Pilot D. J. Perrault of the Celia deposed that he has been a pilot since 1909; that on the morning in question he was on the bridge with the master and first officer, the weather was clear, with but little wind; that he saw, on the port side ahead, a tug; knowing there was a dredge operating in that vicinity he surmised that the tug was in attendance on said dredge; that later he noticed the tug coming down was one of those which he always feared meeting; that he took the wheel from 500 feet east of the tug, then being 200 feet from the shore; that he placed the telegraph at standby, then hard aported the helm when at about 50 feet from the north shore; that the ship had then been stopped and dreading to beach his vessel he gave an order of full speed ahead and hard to starboard and the collision occurred.

He stated that he had enough to do to watch his vessel, and he could not watch the movements of the tug; that he did not stop the ship but kept on as he thought there was no damage done to the barge as it was but a glancing blow; that he did not expect to see a tow in that locality.

The mate, engineer, and wheelman of the Celia also gave evidence and subsequent evidence was taken on the 8th and 18th.

Finding

The court, having carefully weighed the evidence as well as the many points brought out by the respective counsel's able arguments, cannot arrive at any other conclusion than that the Celia is alone to blame for the collision.

Whilst many of the actions of the tug and tow have been criticized in the summary, yet, in view of the fact that by the tenor of the regulations governing the navigation at that point, the Celia was in duty bound to await the passage of the tow into a safe position in order to proceed onward;

Therefore the pilot, D. J. Perrault, who had full charge and control of the ship at that moment, is found to have been wanting in judgment in attempting to negotiate the turn especially in view of the fact that he had recognized the tug as one to be guarded against.

For this lack of judgment the court suspends his license for one month and orders him to pay the costs of this investigation.

Moreover, for the violation of the regulations governing that particular place, the court orders that the maximum fine be imposed, viz., $40.00. The master and officer of the Celia are exonerated from all blame.

"S. V. HARKNESS" STRANDING

THE stranding of the American steamship S. V. Harkness on Red Island, River St. Lawrence, on Aug. 23, was the subject of a formal investigation by Capt. L. A. Demers, Dominion Wreck Commissioner, along with Capts. Francis Nash and Charles Lapierre, in the Wreck Commissioner's Court, Montreal, Aug. 29. A. R. Holden, K.C., appeared on behalf of the Shipping Federation of Canada, in the interests of the owners of the S. V. Harkness. The master was unrepresented by counsel, while a physician's certificate regarding the non-appearance of Pilot Adjutor Lachance was presented to the court by his counsel, Mr. Morin.

Master's Evidence

The Master, Charles A. Cavileer, stated that he had supervised the construction of the S. V. Harkness which was three months old, and had left Puget Sound with a cargo of oil; that she was 5,293 tons net and 6,899 tons gross, with a speed of 10 knots, drawing 28 feet at the time of the casualty, carrying a crew of 37, including three deck officers and four engineers, duly certificated. His compasses were nearly correct, this being proved by his deviation cards. He made every point he expected as prearranged. This was his first trip in the St. Lawrence.

At Father Point, he took Pilot Adjutor Lachance—who, he avers, was sober—and proceeded up the river. The weather being clear he retired to his room. Later he was awakened by the whistle, and came on the bridge, finding a thick fog enveloping the ship. The ship's whistle, being automatic, was sounded at the proper intervals until the pilot ordered it stopped, although the vessel was proceeding at full speed.

He then asked the pilot if it was all right to go full speed, and received an affirmative reply.

The pilot said that the reason he did not want the whistle sounded was in order to permit him to hear the fog horns of the lightships.

He, the master, heard plainly the Red and White Island fog horn; also the explosives on Green Island.

He said the pilot ordered a sounding to be taken,—while the ship was going full speed,—which showed 8 fathoms; but before the second officer could report this to the bridge the ship grounded. She floated later on with the rising tide.

At the time of the investigation the exact damage had not been ascertained; but as water was found mixed with the oil it was evident some injury had been sustained.

The second officer and wheelman submitted corroborative evidence.

Finding

The court held that the pilot alone was to blame for an uncalled for casualty. An inexcusable mistake was made in maintaining full speed through a dense fog for almost two hours; the non-sounding of the whistle for long intervals was a further indefensible action. The court decided to cancel his license, and hold the master blameless due to his being a total stranger in these waters, and doing what was necessary of him under the circumstances.

"MIDDLESEX" — "ARTHUR" — "DUNN" STRANDINGS

THE causes which led to the strandings of the schooner Arthur and barges Middlesex and Dunn while in tow of tugs Myra and Long Sault in the River St. Lawrence on Aug. 13 were formally investigated in the Wreck Commissioner's Court, Montreal, on Aug. 27 and 28, before Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Capts. Francis Nash and Chas. Lapierre. The owners of the Arthur and Middlesex were represented by A. R. Holden, K.C., and the owners of the Myra and Long Sault by A. Wainwright, K.C., and A. H. Elder.

"Arthur" Master's Evidence

Captain James Peacock, of the schooner Arthur, the first witness called, stated that his vessel was 326 tons gross, carrying a crew of seven all told; that he left Cape Vincent in charge of the tug Myra; that after passing out of the canal locks the barges Middlesex and Dunn and schooner Arthur were fastened together, with his vessel in the centre, and the Long Sault was made fast to the tug Myra, and came on down the river in that manner. The current, he was informed, was 11 miles in that part of the river. He depended altogether on the actions of the tugs, and relied on them for instructions. The tow rope was about 127 feet long.

A short while before the grounding the tug Myra all at once began to turn to the south, a hard to starboard helm was acted upon on the Arthur, but to no effect, as the Myra under a hard to port helm continued to starboard and circled by and around the sterns of the vessels in tow, on to the port quarter, when the tow ropes were chopped away, the barge Dunn then striking. The moorings between each barge were cast off. The Middlesex went ashore heading NE., the schooner heading SW. when she brought up.

He avers that he depended on the tugs to give him assistance, and therefore though his anchor was in tackle he did not use it for fear of injuring the bottom of the ship.

"Dunn" Master's Evidence

Captain Edmond Robinaud stated that he arrived near Ogden Island, in a current which he estimated at 10 miles, with the barges and schooner in tow with a line to each vessel; that at that place he starboarded his helm in order to turn to the north shore but his tug turned to starboard, due to the influence of the barges hauling his stern to port. He kept full speed, circling around,—the barges following—and came back on their port side when the Dunn's rope was cast off and the other tow ropes chopped off.

He and his mate endeavored to discover what had gone wrong with the steering gear, and failing to locate the trouble they went aft and disconnected the chain from the quadrant, shipped the tiller and proceeded on. He avers that he does not know how his rudder went, but presumed it went to starboard against the helm. Fifteen minutes elapsed before the tiller was made ready, and the vessel under control.

Captain Adelard Demers, of the Middlesex, said he saw the tug going to starboard, he ported his helm, but did not receive any signals. He let go his anchor, but had not time to let go much cable, the anchor dragging.

Captain Charles Pilon, of the Long Sault, said he had no instructions; that his work was to attend canals and help; that he had received orders in Prescott to tow the schooner Arthur but the pilot would not accept as he dreaded to pilot a vessel with a crew who did not know the river. He did what he was told to do by the pilot.

The mate and a passenger on the Arthur, the engineer of the Myra, and the pilot of the Long Sault also gave further evidence.

Finding

The court having duly considered the evidence of the various witnesses was of opinion that the tug Myra is principally and chiefly to blame for this casualty. In view of the evidence the court must exonerate both the schooner Arthur and barge Middlesex of all blame, and moreover must state that under the circumstances there was little time left them to consider what should best be done in connection with the anchors, and it does not seem that even had the anchors been dropped they would have been of much avail.

Re Tug "Myra"

The court supposes that in the absence of a duplicate system of steam and hand gear that it would be necessary, yea obligatory, to order the bolts uniting the chains to the quadrant cast off, so that the change could be made with as little delay as possible; but in this case it would appear that the master and mate fooled around with machinery they did not know much about, for a period of 15 minutes or so, and failing to remedy matters they resorted to uncoupling the chains from the quadrant and, as the master of the Myra said, it took a while to do so as the bolts were long.

The proper action would have been to call the engineer to see what was wrong with the steering gear, and at the same time immediately proceed to get the hand gear in operation, and had this been done it is possible that before the tug had completed the circle the tiller would have been in place and the rudder operative in such manner as to enable the tug to head the current and by a signal to cause the barges to let go their anchors until more effective help could have been rendered. Had this method been adopted this casualty would not have been registered.

The court contends that there was an error of judgment, lack of proper seamanship, in not immediately proceeding to change the steam steering gear to hand gear, and in not conveying to the barges, by words or deeds, a knowledge of the predicament in which the tug was, and for this error of judgment the court holds the tug Myra in fault, as before stated, for this casualty, resulting in the groundings of the schooner Arthur and barges Middlesex and Dunn.

The court did not hold the barges or schooner to blame for the strandings, and for lack of judgment and seamanship suspended the Master's Certificate, No. 872, of Captain Edmond Robinault, for a period of three months from August 28 to November 28, 1917.

Re Tug "Long Sault"

This tug had a mission, so the evidence shows, and it was confined to canal performance. This is accepted by the court; but in view of the fact that she was tied to the Myra, and at a specific time she helped by, and with her engines, to straighten the Myra, though unsuccessfully,—since such help and assistance was given she became part of the tow, and jointly with the Myra must share the responsibility of this casualty, but to a lesser degree.

Therefore the master must be held at fault for failing to attempt to render assistance, but as this failure is considered secondary compared to the Myra, the court will only suspend his certificate for one month from the time of its delivery to the court.

The owners of each tug were ordered to defray the cost of this investigation, the owners of the Myra to pay two-thirds and the owners of the Long Sault the remaining one-third.

STANDARD SHIPS—POLICY IN DESIGN

THE commissioning of the first unit of the Government's programme of standardized shipbuilding, and the launch by the King at Greenock, Scotland, recently, of "a vessel of a new type, designed for merchant service," were events which, but for the restrictions imposed by the war, would have given occasion for wide discussion, says a writer in the Times Engineering Supplement. In present circumstances, however, nothing can be published about the methods which are being adopted to render these vessels as immune as possible from being sunk by torpedoes or mines; but this much may be said, that in no sense do they represent any radical departure from previous practice in naval architecture. They are ordinary cargo carriers, similar in general design to many that were built in previous years, capable of taking their place in the British mercantile marine after the war is over, but they embody in their fitting-out many new ideas, each representing an effort to beat the enemy submarines by defensive or offensive methods, and all combining to make them more safe in this respect than any cargo vessels have been since the war began.

It is realized that safety is not to be found in any single specific, but in a combination of ideas each of which has either been proved valuable by experience or promises well in theory. In this respect the standard ships represent a bundle of compromises, while in the matter of hull designs they represent the elimination of variety, and the reduction of plans to a level of uniformity which should enable tonnage to be produced more rapidly than ever it has been produced in the past. The fact that hull designs have been standardized, and not revolutionized, is not a little significant. It shows that those responsible for the scheme have discarded the many suggestions for "unsinkable" ships, and placed their confidence in that which experience had proved to be good, supplemented by all the expedients for increasing safety which could be adopted with hope of success, and without making each vessell other than a good seaworthy and efficient cargo carrier.

Conservatism and Progress

This is a point which must always be remembered when the merits of the scheme of standardized shipbuilding are considered. There have been very few rash experiments in British shipbuilding. An occasional "freak" boat has been constructed, but as a whole the history of British shipbuilding is a story of great restraint and scientific conservatism, of the development of theories to the point when their success is assured before they are put into actual practice, and of preliminary experiments so conclusive that there was no danger of failure when actual vessels were produced. It was largely this innate conservatism that prevented the adoption of revolutionary ideas in the standard ships.

The Shipping Controller's Advisory Committee declined to rely on untested theories when the demands of the war were calling for the largest possible supply of efficient cargo tonnage, and they therefore decided that a large number of vessels of thoroughly dependable types should be built—types which would not only do a known amount of work after being commissioned, but with the construction of which all shipbuilders and marine engineers were familiar, and which could, therefore, be turned out rapidly once the standardized programme was fairly set a-going.

The time was seen not to be one for experimenting with vessels the value of which was an unknown quantity, and therefore all the proposals for revolutionary plans were turned down, and cargo steamers in three classes, propelled not by turbines or internal combustion engines, but by ordinary reciprocating engines, were ordered and are now being constructed at many of the shipyards in the United Kingdom. This is a remarkable illustration of that conservatism in methods to which reference has been made, and of that "safe" policy which looks like want of enterprise, but which so frequently proves wisest in the long run. It is a policy of safe progress, and its best justification is to be found in the story of British shipbuilding and marine engineering.

Now the idea of an unsinkable, or practically unsinkable, ship is being recommended, and the Admiralty and the Ministry of Shipping are being criticized because they decline to do more than express a favorable opinion on the plans put before them. Whatever the merits of these plans, their adoption would mean an interruption of the standardized programme. It is, in all probability, purely a matter of what may be called tactics. Now that the standard programme is fully under way the stage is presumably seen approaching when it will act as an effective set-off to the enemy submarine campaign; hence it is not considered wise to make another new beginning, especially with a scheme which is bound to be experimental in its early stages.

As to the unsinkable ship as such, it is an old will-o'-the-wisp, which many good men have followed, but which no one has yet caught. It would be quite possible to construct something which would continue to float for a very much longer time than anything at present in existence, and that in spite of very serious attacks by mines, submarines, or gunfire. It might even float until it was wholly destroyed, but it would not be a ship, because it would be of little or no value as a ship. Take, for example, the question of internal subdivision. By means of extreme subdivision—many transverse and longitudinal bulkheads carried up to or above the main deck, and with no openings leading from one compartment to another—the buoyancy of a ship might be preserved after she had been attacked many times; but the amount of subdivision necessary to make her even relatively safe would make her useless as a ship. Numerous bulkheads without openings, the only communications between the compartments being by the top decks, would render her very difficult to work, while with many small compartments her cargo could not be handled expeditiously, and she would represent the very opposite of that clear-hold type which is so efficient and economical, and towards which the designers of cargo steamers have been working for many years past.

Again, all forms of "outside" protection, such as screens after the fashion of the old-time torpedo nets around warships, are open to the unanswerable objection that they would enormously reduce the speed and the steering and manoeuvring power of any vessel to which they were attached. The latest idea from America, that each transport crossing the Atlantic should carry along each of her sides, at some distance off, a wall of steel plates, so that she would be sailing all the time within these walls, is the torpedo net carried to its extreme limits, and it is open to the same objections, but to a much greater extent.

The simple fact is that a ship must be a ship first and foremost, and any alteration in design, or any protective device, which detracts from her value and efficiency as a ship is ruled out by that fact. The true line of progress is that on which we are moving—that of maintaining efficiency and also utilizing every plan which assists in defying the enemy without spoiling the ship as a ship.—Times Engineering Supplement.

Statements have been published in Swedish newspapers concerning a new type of German submarine which is said to have a length of 430 ft., a beam of 34 ft., engines of 20,000 h.p., and a speed of 28 knots above and 15 knots below the surface. The vessel is said to be capable of carrying 76 torpedoes and 150 mines and to be armed with six 4.7 in. guns.

GREAT LAKES AND ST. LAWRENCE

Water Transportation From the Atlantic to the Heart of Canada is one of the Live Issues of our Time and is Daily Becoming of Increased Importance

OCEAN FREIGHTER LAUNCHED AT TORONTO

THE ocean going cargo steamer Tento, which was launched at the Polson Iron Works, Toronto, on Monday, October 22, has been about twelve months under construction. The difficulty of obtaining steel was responsible for the more or less abnormal building period. The Tento which is the first of two vessels ordered by Norwegian interests was christened by Mrs. Andre Refues. Capt. Winstrup will be in command of the ship on completion. A distinguished company was present at the launching ceremony including many who are individually prominent in marine and railroad circles. It is expected that the Tento will undergo her trials in about five weeks time.

Constructional Features

The vessel is of standard construction for ocean service and so designed as to be able to navigate the St. Lawrence canals to the sea when in ballast. Her mean draft will be 19 ft. 6 ins. when carring a total deadweight of 3,500 tons. The principal dimensions are as follows: Length over all, 261 ft.; length between perpendiculars, 251 feet; beam moulded, 43 ft. 6 ins.; depth moulded 23 ft. The Tento is a single screw steel freighter built to the highest class Bureau Veritas. The engine room, boiler room, and navigating bridge deck are amidships with cargo spaces fore and aft of the latter. The ship is of single deck type and is built on the deep frame principle. The deep frame system with auxiliary side frames constitute the basic constructional features of the hull fabrication. She has a cellular double bottom fore and aft, also peak tanks and four watertight bulkheads. The shell plating is overlapped at the edges with overlapped scarf butts. The bow plates between light and low draught lines are thickened about 25 per cent. as provision against ice, tapering to normal thickness at from 20 ft. to 30 ft. sternwards. The keel, double bottom floors, and frames are machine riveted. The main, poop and bridge decks are steel and the forecastle deck of pitch pine. There are two forward cargo hatches 18 ft. by 28 ft. and two aft cargo hatches 18 ft. by 28 ft. Two wood pole masts and four large cargo derricks with a winch to each are installed.

OCEAN-GOING FREIGHTER "TENTO" ON WAYS AT POLSON IRON WORKS, TORONTO.

Deck Machinery

For handling cargo, there are six 7 in. by 10 in. horizontal double cylinder steam winches of Clark-Chapman type, one at each mast and derrick. The winches have central barrels and drums, and are placed on girders above the deck. Each mast carries one pitch pine, 3 ton derrick, the latter long enough to land cargo 10 ft. away from ship's side. The windlass is of direct-acting type for operation by hand, as well as by steam, and is complete with reversing gear. A hand screw steering gear is installed aft, and a steam steering gear amidships. The total bunker capacity is about 350 tons.

Suitable accommodation for the officers and crew is provided, the sailors and firemen's quarters being aft, and those of the officers on the bridge deck. Two lifeboats and one dinghy will be carried by the ship, other equipment and fittings being in accordance with the classification requirements.

Main Propelling Engines

The propelling machinery has been constructed to Bureau Veritas requirements for a working pressure of 180 pounds per sq. inch. The main engines are of inverted, direct-acting, surface condensing, triple expansion type, the cylinders being 20½ ins., 33 ins., and 54 ins. diameter by 36 ins. stroke. The condenser and pumps are independent of the main engine structure. The H.P. and I.P. cylinders are served by piston valves, and the L. P. cylinder by a double ported slide valve. All these

FITTING OUT BASIN AT POLSON IRON WORKS, TORONTO, SHOWING SIX FISHERIES PROTECTION VESSELS RECENTLY LAUNCHED.

valves are on the fore and aft centre line of the engine. The bed plate is of box section cast iron, as are also the columns. All shafting is of best openhearth forged steel. The crank shaft is of built-up type, with cast steel crank arms. The connecting rods, crossheads, and piston rods are of openhearth, forged steel. The valve gear is of Stephenson link motion type, with direct acting steam reversing gear. The propellers are four bladed of cast iron.

OCEAN-GOING FREIGHTER "TENTO" BEING LAUNCHED.

Auxiliary Machinery Equipment

The pumping equipment includes deck pumps for each hold; vertical duplex, brass-fitted, main boiler feed pump; a duplicate of the latter for use as a general service donkey pump; duplex horizontal piston type bilge pump; a 7 ins. duplex, brass-fitted, ballast pump; and a fresh water pump, 4½ ins.—4 ins.—5 ins. of duplex type; air pump and centrifugal circulating pump for main condenser. The feed water heater is of multi-coil type installed in the feed pump discharge line. One 7½ k.w. Enberg electric generating set is installed in the engine room for the ship's lighting system. An evaporator of 15 tons capacity is also installed in the engine room.

Boilers

The boiler installation consists of two 14 ft. diameter by 12 ft. long, single-ended, Scotch marine type units, arranged for natural draft only, and built to pass Bureau Veritas requirements for 180 pounds working steam pressure. Each boiler has three corrugated steel furnaces of 42 ins. inside diameter. The tubes are 3½ ins. diameter, lap welded and standard gauge. A separate combustion chamber for each furnace, and one double funnel are other features.

CANADIAN STEEL CORPORATION ACTIVITY

THE Canadian Steel Corporation, Ojibway, Ont., have entered into a contract with the Great Lakes Dredging Co., Port Arthur, Ont., for the construction of a marine slip or harbor, also unloading docks or wharves, to provide for the unloading and storage of ore, limestone and coal. The marine slip or harbor will extend about 2,403 feet inland from the harbor line along the left bank of the Detroit River. Its width, from face to face of the concrete walls (which will be 9 feet high by 12 feet wide), will be 400 feet. This reduces to 202 feet between walls at a distance of 303 feet from the harbor line. It continues at the width of 202 feet for a further distance of 2,100 feet inland from this point. The depth will be 23 feet measured from the mean water level of the Detroit River. All piles supporting concrete walls will be approximately 80 feet in length and will be driven to rock. Ore and limestone will be unloaded and stored on one side of this slip, and coal for by-product coke ovens and general plant use on the other side. The work does not include piling or concrete walls for support of bridges; neither does it include any unloading machinery.

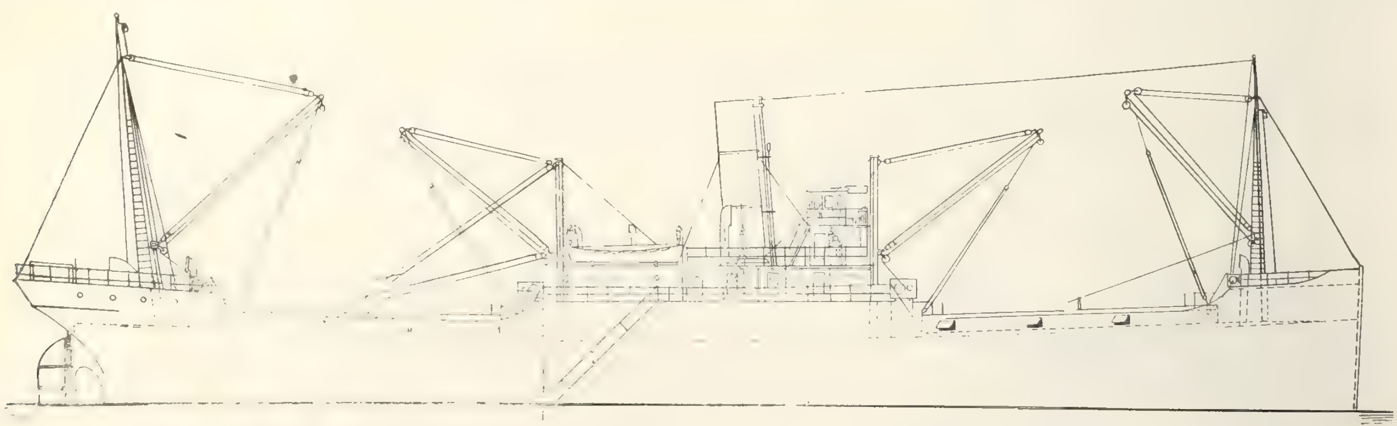
LAKE LEVELS

THOUGH the level of each of the Great Lakes in September was above the average for that month in the past ten years, all, with the exception of Lake Superior, were lower than in August. The stages of each of the lakes in feet above mean sea level in September and in August, as reported by the United States Lake Survey Office, Detroit, were:—

	September	August
Lake Superior	602.73	602.69
Michigan-Huron	581.68	581.90
St. Clair	576.25	576.62
Erie	573.28	573.57
Ontario	246.93	247.35

LAKES SEAMEN GET WAGE INCREASE

AT a meeting of the Wage Scale Committee of the Lake Carriers' Association a schedule, effective October 1, calling for an advance all along the line has been adopted. The new schedule is by far the highest ever paid on the lakes and is much higher than the scale paid on the coast. The question of wages for licensed officers, including captains, engineers and mates on the vessels in the association, was not taken up at the meeting, but it was decided that there will be an adjustment made of the salaries of all licensed officers, which will be announced later. The minimum wage scales per month recommended for all vessels in the membership of the association will be as follows: Boatswains, $105; stewards on vessels over 4,000 gross tons, $130; stewards on vessels under 4,000 gross tons, $115; second cooks, $70; waiters, $60; firemen, oilers and water-tenders, $95; porters, $60; wheelmen and lookouts, $95; ordinary seamen, $60; coal-passers, $80.



STEEL FREIGHTERS FOR OCEAN SERVICE BUILDING BY THOR IRON WORKS, TORONTO.

WOOD SHIPBUILDING AT MONTREAL

AMONG recently established wood shipbuilding plants, attention may be directed to that of Fraser, Brace & Co., of Montreal. Although a new departure for this firm, they go into it with a wide expert knowledge of large construction work and engineering undertakings generally. They have acquired a very desirable location for the plant site, which consists of approximately eight acres adjoining the Lachine Canal, on the south side of the latter and in the district known as Cote St. Paul. The shipyard offers ideal conditions for its specific purpose, forming an old basin that is readily and rapidly being transformed into an excellent slip or dry dock. When this basin was formerly used, the entrance was bridged by the bascule bridge on the C.P.R. which runs parallel to the canal; the abutments for the bridge being of concrete. The dam that at present prevents the water of the canal from entering the basin will eventually be replaced with a lock gate, so foundations which have been laid on the eastern bank of the slip. The illustration shows one of the main keel timbers being laid in position for the first vessel. The first two will be side-launched when completed. The keels for the other two will be laid in the bed of the slip, and when the boats are finished they will be floated by simply flooding the slip, water being allowed to pass through the canal entrance. This method will eliminate the construction of launching ways and will also facilitate the actual "launching" operation.

A tentative contract has been obtained for other four boats of the same class, and provision is being made to accommodate the entire eight at the one site; four in the slip and the remainder on the upper level. Buildings have been erected for offices, stores, air compressors, transformers, saw mill, also carpenter and machine shops. A mold loft 150 feet by 50 feet has also been provided. The power used throughout will be electric. The property adjoins both the G.T.R. and the C.P.R., admitting of

This vessel is intended for ocean service exclusively and is of the following dimensions: Length, 250 ft.; breadth, 43 ft. 9 in.; depth, 25 ft. moulded. The vessel is divided into five cargo tanks, and with a longitudinal counterline bulkhead running the full length, making ten oil tanks in all. A fuel oil bunker is fitted immediately in front of the boiler-room and a bulkhead separates this from the main cargo tanks.

The main propelling machinery consists of one set of triple-expansion engines having cylinders 18, 30 and 50 inches by 36 inch stroke, steam being supplied by two single-ended Scotch boilers 13 ft. 6 in. diameter by 11 ft. long, steam pressure 180 lbs., working under natural draft.

The oil pumping arrangement is of the most elaborate kind of design, the object being to handle the cargo in the most expeditious manner.

The fifth steamer of this type for the same company may be launched this week.

SHIPYARD OF FRASER, BRACE & CO. IN THE MAKING AT MONTREAL. NOTE THE KEEL TIMBER FOR A WOOD SHIP BEING PLACED IN POSITION.

that the basin will form a dry dock 600 feet long and 150 feet wide; sufficiently large to provide erection and working space for four wood ships, each of which will be 250 feet long and of 42 feet beam.

Excavation is nearing completion, as will be seen from the accompanying photograph which shows the progress made at the middle of the present month. The buildings in the background are being equipped with the most modern machinery, so that with the possible exception of the first two vessels, and probably even for a large portion of these, the timbers used in the ships will be dressed directly from the logs being brought in by rail from the forests of Quebec and adjacent territory. For the present and immediate future, the timbers required will be brought from Oregon and British Columbia. The initial contract secured is for four standard 2,500 ton boats, and the keels for two of these are now being placed on the pile facilities for the handling of materials promptly and direct to the job.

It is anticipated that within a few months Fraser, Brace & Co. will have a force of about 600 men employed as the first four boats are to be delivered by the middle of 1918. Their contract covers the building of the hulls only, the installation of propelling machinery, general equipment and the interior fittings being taken care of by other contractors.

S. S. "REGINOLITE" TRIAL TRIP

THE fourth oil tank steamer, the Reginolite, which Collingwood Shipbuilding Co. has on contract for the Imperial Oil Co. of Sarnia, was given a trial trip, on Sept. 30. The day was stormy, but the steamer came up to the mark in every detail, and especially in the matter of speed, the contract in this being exceeded by one and a half knots per hour.

U. S. LENDS STEAMERS TO ITALY

THE United States Shipping Board has agreed to charter to the Italian Government approximately 25 American commandeered steel ships of an aggregate of 100,000 deadweight tons, to relieve Italy's shortage of shipping for the transport of urgently needed supplies. This action was onnounced on Oct. 26 by Chairman Hurley, of the Board. Great Britain has been supplying France and Italy with shipping to meet their emergency needs, but cannot continue to do so in view of her own increasing shipping requirements.

Italy has strongly represented its great need, and she gets five more ships than were allotted to the French Government earlier in the present month.

Part of the ships chartered will be old and part new, and some may be taken from those on the way from the Great Lakes to the ocean. They will be used between the United States and Italian ports.

Canadian Built Compound Surface Condensing Marine Engine

Staff Article

While the real extent to which Canadian shops are assisting in defeating the enemy on sea will perhaps never be known, the manner in which help is being rendered is familiar to most of our readers. The engines described herewith are purely a war-time product so far as design and material are concerned, but the fact that experience in the production of such items is being obtained on a wide scale is a factor of considerable importance at this time.

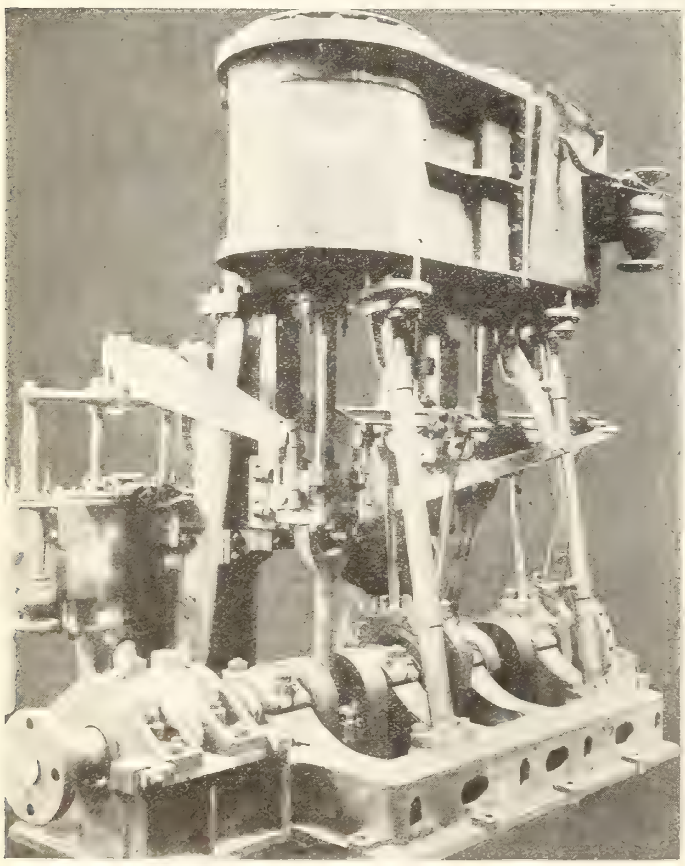
WITH the possible exception of the munitions activity of two years ago no other industry has made such rapid and remarkable advancement as that of shipbuilding. The developments in this direction have undoubtedly been hampered to a large degree by prevailing conditions, owing to the difficulty of obtaining labor and material. The labor problem is at present however, much relieved as a result of curtailment in the manufacture of shells, but the inability of securing plates for the construction of steel vessels, continues to be a deterring factor in the laying down of this type of boat. Irrespective however, of the class of hull, it is essential that power facilities be installed for the efficient operation of modern cargo vessels.

The accompanying cuts illustrate the design of a compound marine engine being constructed by various Canadian firms. The boats for which these engines are intended are 85 ft. long, 19 ft. 3 in. beam with a draft of about 11 ft., and will be used for ocean service. The boilers are of the Scotch multitubular marine type, 9 ft. 6 in. dia. by 9 ft. long, having two plain furnaces with separate combustion chambers. They are to have a working pressure of 140 lbs. per sq. in.; and before leaving the works were given a cold water test at double the working steam pressure and afterwards subjected to a steam test to meet the requirements of Canadian Government inspection.

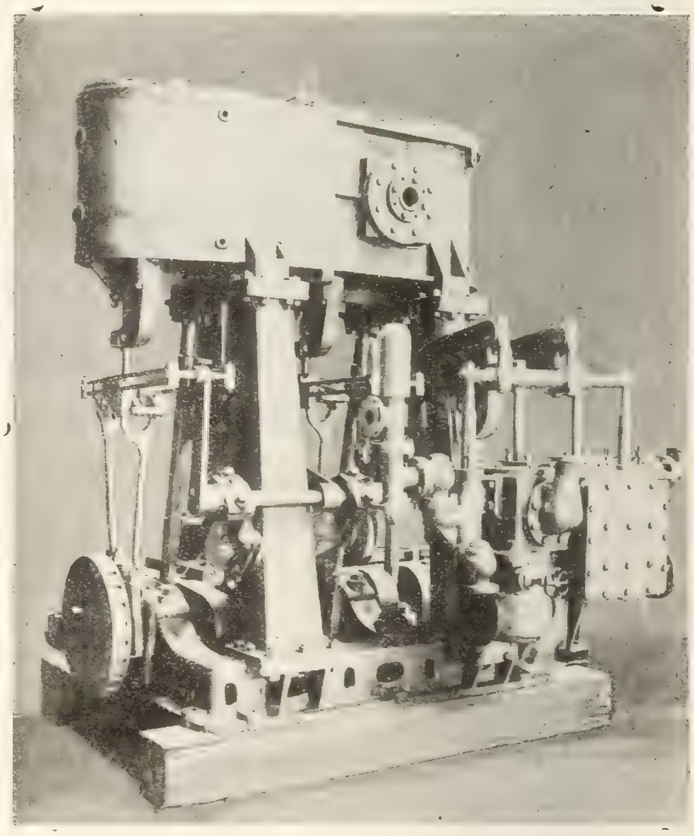
Frame and Cylinders

The bed plate of the engine is of heavy ribbed cast iron with flat bottom, having a depth of over 12 in. below the bearings. The main journal boxes are fitted with dovetailed sections of white metal that are well hammered into place, the bearings being so designed that the bolts that hold the caps can be freely removed after engine has been placed in position. Liners and distance pieces are provided, the liners being the same thickness as the babbitt metal and the distance pieces being equal to 1-7 the diameter of the bearing. The framing that supports the cylinders consists of cast iron columns at the back, the front columns being of forged steel, securely fitted to the bed plate and seatings of the cylinders. The cross head guides are of the hollow rectangular type for water circulation.

The cylinders are of hard close grained cast iron having a minimum thickness of 1⅛ in. The high pressure cylinder has a diameter of 12 in. and the low pressure cylinder 26 in., with a stroke of 16 in. The H. P. cylinder is fitted with a piston valve, the L. P. having a double ported slide valve. Facilities are provided for observing the setting of the valves without removing the covers. Cylinder covers are provided with eyebolts for hoisting and also suitable set screws for starting the joints. All covers are secured with steel bolts and fastened with case-hardened wrought nuts.



VIEW OF OPERATING SIDE OF 12 x 26 x 12 IN. COMPOUND MARINE ENGINE. THRUST BLOCK IN LEFT FOREGROUND



REVERSE SIDE OF ENGINE SHOWING BARRING WHEEL, VALVE GEAR, AIR, FEED, AND BILGE PUMPS

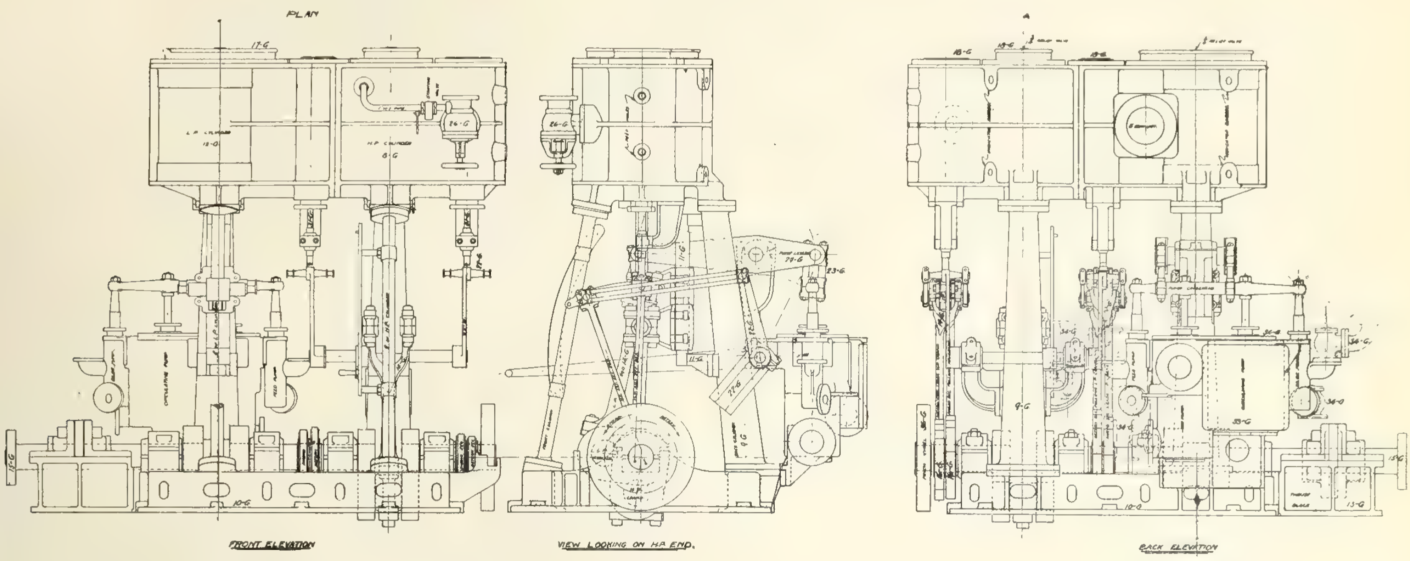
The pistons are of cast iron fitted with especially hard cast iron rings, the followers being secured in position by steel studs screwed into the pistons, bodies of the studs of the collar type and fitted into square holes in the followers. The piston rods are machine steel forgings, the ends being taper fitted into the piston and the cross head. The cylindrical portions of both piston rods are accurately ground to dimensions and highly polished. The stuffing boxes for piston rods

and valve stems are made of composition and fitted with metallic packing with ample lubricating facilities.

Operation of the Valves

The operation of the valves is obtained by means of the Stephenson link motion, the eccentrics being made of cast iron, while the straps are cast steel lined with white metal fitted into dove-tailed recesses and well hammered into place. The eccentrics are carefully fitted, by scraping, both on the face and rabbits, and channelled with oil grooves. The eccentric rods are made of high grade machinery steel forgings and fitted to the straps with collar stud bolts. The upper ends are fitted with adjustable brasses with the necessary gibs, set screws, etc.

All pins for the eccentric rods are forged on and accurately finished. The links of the double bar type, are so designed that when operating in forward position the passage way is not obstructed. The valve stems are connected to the link blocks with composition boxes, marine end type. Machinery steel link blocks are used with the jaws spanning the bars of the links; the jaws are fitted with composition gibs finished to the curve of the links and fitted with adjusting screws, the lower gibs having screws with lock nuts. Suspension bars are attached to the links at such a position that motion between the link and the block is reduced to the minimum when engine is in the ahead position. The reversing shaft is of steel with arms and pins for connection to the suspension bars forged to the shaft.



ELEVATIONS OF 12 X 26 X 16 IN. COMPOUND EXPANSION MARINE ENGINE FOR CANADIAN-BUILT HULLS.

Crossheads and Connecting Rods

The crossheads are of high grade machinery steel with the journals forged on; the gibs for the slippers are lined with approved anti-friction metal both on the ahead and astern sides, cast and peened in place. The gibs are provided with lips at the top and bottom, liners being furnished for adjustment when taking up the wear. The slippers are designed with sufficient area so that the pressure on the anti-friction bearings will not exceed 40 lbs. per sq. in. and are amply supplied with oiling facilities.

The connecting rods of machinery steel are 40 in. long between centers, forked to span the crossheads and finished all over. The bearing boxes at either end are of composition and secured by forged steel bolts, the crank end being fitted with sections of white metal.

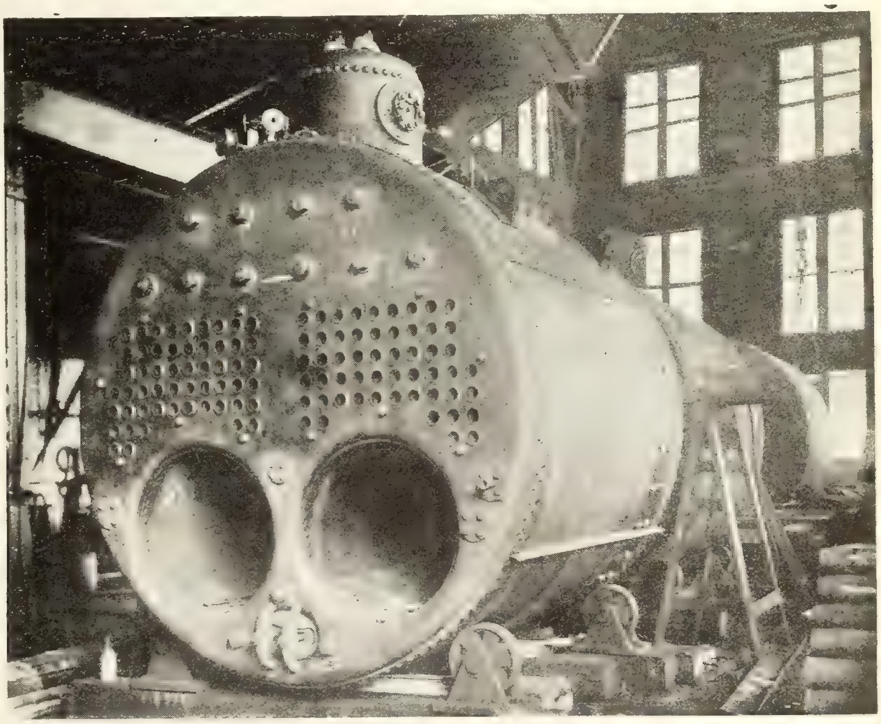
Crank Shaft

The crank shaft main journals are 5½ in. dia., with crank pins of a similar diameter and 6½ in. long, enlarged in the webs. The crank webs are of ample size with raised seatings for eccentrics forged on; the holes in all the couplings are drilled and reamed, and the bolts snugly fitted with a parallel body and the nuts locked with suitable split pins. The two cranks are set at an angle of 90 degrees with each other.

The thrust shaft is made of high grade machinery steel and has six thrust collars. The bearings are of the horse shoe type with four or more of the shoes fitted with anti-friction metal on both sides, and provided with suitable adjustment and also ample oiling facilities and water circulation for each shoe. There is also fitted at either end bronze stuffing boxes to prevent the escape of the lubricating oil. These bearings are designed to withstand a thrust of not more than 45 lbs. per sq. in.

Accessory Equipment

Independent surface condensers are provided, having tubes of seamless drawn



SCOTCH MARINE TYPE BOILER 9 FT. 6 IN. X 9 FT. FOR 140 LBS. WORKING PRESSURE.

brass No. 18 B. W. G. secured to the tube sheets with screw ferrules and packing, the tube sheets being amply stayed with through bolts. The condenser heads are removable without disturbing any of the piping connections. The cooling surface on the exterior of the tubes having a total area of over 400 square feet and before leaving the works the condensers are tested under a pressure of 20 lbs. to insure the soundness of the joints.

Directly mounted on the main engine and operated by levers connected to the L. P. piston rod, is the air pump, feed pump, and bilge pump; also a general service pump, Blake type. Other auxiliary equipment consists of a cast iron centrifugal circulating pump, brass fitted, direct connected to a vertical slide valve engine. The tail shaft is fitted with brass sleeves, and the end tapered to suit the propeller of cast iron four blade type. The tail shaft operates through a cast iron bearing lined with lignum vitae.

All bearings throughout are amply provided with efficient oiling facilities and the piping is sufficiently large to insure a regular supply of lubrication at all times. Wherever possible sight feeds have been provided for the convenience of the operators. The water circulation to the various surfaces requiring cooling is passed through brass piping. Before being shipped these engines are given a test under steam and must comply with various official requirements.

GEARED TURBINES VS. OIL ENGINES FOR SHIPS

A GOOD deal has been said and written with regard to the economy of the geared turbine and its possibility of supplanting the oil engine; therefore, a few relative figures will perhaps be of interest in this connection, says the "Motor Ship and Motor Boat."

It is now so often forgotten by the advocates of the steam engine that steamship owners who have not launched out into the construction of motor ships are becoming more and more converted to the use of oil fuel, and recognize that even though the cost of running a steamer with oil-fired boilers is considerably greater than when coal is used, the economy in stokers, the convenience, cleanliness, and greater readiness for immediate service are sufficient to outweigh the consideration of fuel economy. It is, therefore, now quite usual to find that geared turbine ships are operated with oil-fired boilers, and generally, when comparisons are made, they have to be between a motor ship and an oil-driven steamer.

One of the most recently-constructed vessels in which geared turbines are fitted is the Edward Luckenback, built by the Fore River Shipbuilding Co., of Quincy, Mass. She is 456 feet overall, has a deadweight capacity of 12,250 tons, and a gross tonnage of 8,150. The machinery consists of a Curtis steam turbine running at about 2,400 r.p.m., and developing 400 b.h.p. The gearing is such that the propeller runs at 90 r.p.m., so that the conditions are as favorable for economical operation as it is possible to devise with both turbine and propeller running at speeds giving the maximum efficiency in each case.

Trial Trip Data

On the trial trip of this ship very complete data were obtained of consumption of fuel oil, using Mexican oil with a calorific value of 18,170 B.t.u's. At varying powers the following results were obtained:

B.h.p.	Lbs. of oil per b.h.p.hour.
3,250	0.98
3,750	0.98
4,150	1.00

The most economical consumption was thus recorded between 3,250 b.h.p. and 3,750 b.h.p., or, say, at an average of 3,500 b.h.p. This allows of an excellent comparison with the motor ship Fionia, in which the total machinery power amounts to almost exactly 3,500 b.h.p. In this vessel, which is equipped with two four-cycle Burmeister & Wain engines, the consumption per b.h.p. hour is 0.37 lb., or even less, being just about 36 per cent. of the steamer of the most modern type, and representing an economy in the fuel bill of 64 per cent. In reality it is more than that, since there is an additional saving due to the auxiliaries being electrically operated and the electric power obtained from Diesel-driven generators; it is, therefore, quite within the limits of accuracy to say that the motor ship shows an economy in the fuel bill of more than 70 per cent.

Even with two-cycle engines, which are by no means so low on fuel consumption as the four-stroke type, the saving is extremely large. In the Hamlet, for instance, with two 1,650 b.h.p. two-cycle Polar engines, the fuel consumption was about 0.44 lb. per b.h.p. hour, or about 45 per cent. of the steamer, representing a saving of 55 per cent.

All these are exact figures derived from official trials, and are not to be gainsaid. They make it quite clear that, from the point of view of fuel economy, the oil-fired geared turbine installation does not compare with the motor ship, and as this former represents the very latest development in steam marine machinery, the internal-combustion engine still shows to enormous advantage in comparison.

REINFORCED CONCRETE MOTOR SHIPS

OWING to the impossibility of being able to build steel or wood coasting vessels for their fleet of Miramar motor coasters, and to the fact that both vessels they have completed have been requisitioned by the Government, James Pollock, Sons, & Co., London, the owners, have decided to construct reinforced concrete vessels, says the "Steamship." They have completed the plans and details; and, with the necessary sanction, will be able to start immediately.

The first vessel to be laid down is practically a sister ship of the Leelee, with a length of 92 feet 4 inches, a breadth of 19 feet, and a depth of 10 feet. This concrete vessel will have a motor winch, the usual raised quarterdeck and forecastle, a large hold, hatchway, and engine aft. The latter will consist of a Bolinder "M" type engine of 120 b.h.p., which does away entirely with water drip, and has an invisible exhaust, a feature of considerable advantage in these days when submarines can pick up steam vessels a long distance off, when they are emitting smoke. The same firm have also completed designs, and are about to construct a swim barge of 130 tons capacity for the Thames. This will have new features, and will be entirely of reinforced concrete.

With the materials used, all these vessels will be perfectly tight in a few weeks after construction, and are calculated to be slightly stronger than a steel vessel six weeks after construction. Thereafter, the strength of the reinforced concrete would gradually increase, the maximum strength not being attained until the vessels are fifteen years old. It is a little difficult to say at the present moment what the life of these barges will be, but, even allowing for a slight "fatigue" of the steel and concrete, there is no reason why each vessel should not be extremely useful when several hundred years old. They will be able to resist a local 20-ton blow by collision with another vessel, or otherwise, at one point, and the weakest point at that, without damage.

The contract also provides extreme tests, such as when the vessel is light and without cargo, holding her up at each end whilst the centre is totally unsupported. When the vessel is uniformly loaded she will be left on a bank in the river or a camp-shed, with one-third of the stem or stern overhanging without any support whatever. A further test will be by supporting the whole of the vessel when light on a transverse block amidships, the ends being totally unsupported.

CONCRETE SHIPS FOR GREAT LAKES

SHIPS of concrete are to be built near Detroit by the Torcrete Shipbuilding Co., recently organized in Chicago. The company is now negotiating for a suitable site on which to begin building 1,200-ton reinforced concrete vessels after what is known as the Torcrete system. The steamers are to be built for Great Lakes service. Additional yards will be established later, it is said, in New York, New Orleans and Los Angeles. A number of designs for these concrete ships, lighters, and barges, have been prepared, and the plans have been submitted to the United States Emergency Fleet Corporation and the Government, with a view to assisting in the construction of merchant marine shipping. Torcrete is a combination of steel and concrete, the practical application of which is described as creating a laminated hull inside steel reinforcing. It is applied under air pressure, following a new process.

CANADA'S ATLANTIC SEABOARD

Shipping and Shipbuilding Enterprises and Industries are Again in the Ascendency in Our Maritime Provinces, and Revival of the Old-Time Activity Appears Imminent

P.E.I. CAR FERRY SERVICE

DURING the present month, the car ferry steamer Prince Edward Island is expected to begin her regular service between Point Borden, Prince Edward Island, and Cape Tormentine, New Brunswick, thus ushering in a new era in transportation to and from Canada's Island Province.

For several weeks the steamer has been engaged in carrying over from Tormentine the transfer shed, which is to be placed at Point Borden, and which had been built in sections at Moncton. The work at the terminals is not quite complete, although the finishing touches are at present being given to them. The pier, breakwater and docks have all been completed by the contractors, Roger, Miller Co., of Shediac.

Style of Dock Construction

The operations began in January, 1914, and as a result of three years' work, the most important structure is a pier 2,240 feet long and 20 feet wide on top inside the sea-wall. At the outer end of this pier is the dock for the steamer. This dock is composed of nine concrete cribs, each 113 feet long, and weighing 2,500 tons with 300 tons of reinforcing steel in each. These cribs extend 22 feet below low water mark and 13 feet above. They rest on a foundation of rock, which had been levelled off to receive them.

The cribs were built at Point du Chene. They are of cellular construction, some containing 27 pockets, others 30. After being towed over and placed in position, they were filled with concrete, thus making a solid mass. The core of the remainder of the pier, is of stone, known as "quarry run." The slopes are laid with heavy Wallace stones, not less than five tons each, built to fit in with one another. These stones were laid by means of a cable-way, being handled by an endless chain between two towers, one on the pier and the other on the bank, about 1,500 feet apart. The pier is of curving formation, and has a J termination, the hollow part of which forms a dock for the steamer.

In order to prevent the boat from being damaged by coming into contact with the concrete, an automatic fender, designed by the Roger, Miller Co., has been built. This is composed of vertical piles, with their steel points driven into the rock. These piles are set in pairs, between them timbers are set lengthwise, and there are a number of other piles built in to strengthen the structure. There are 64 plungers altogether, fitting into a pipe and resting against clustered car springs. By means of these springs, the compression of the boat is taken up, and 100 tons of pressure will close the springs up a foot.

Transference of Cars

The cars are taken on and off the steamer by means of a large steel transfer bridge or apron built by the Dominion Bridge Co. This has six large gantries with an apron girder suspended from the top. The apron is in three sections, the outer one of which rests on top of the steamer's stern. By means of counter-weights, the structure is so balanced that it can be hoisted or lowered by means of a small steam engine to suit any condition of the tide.

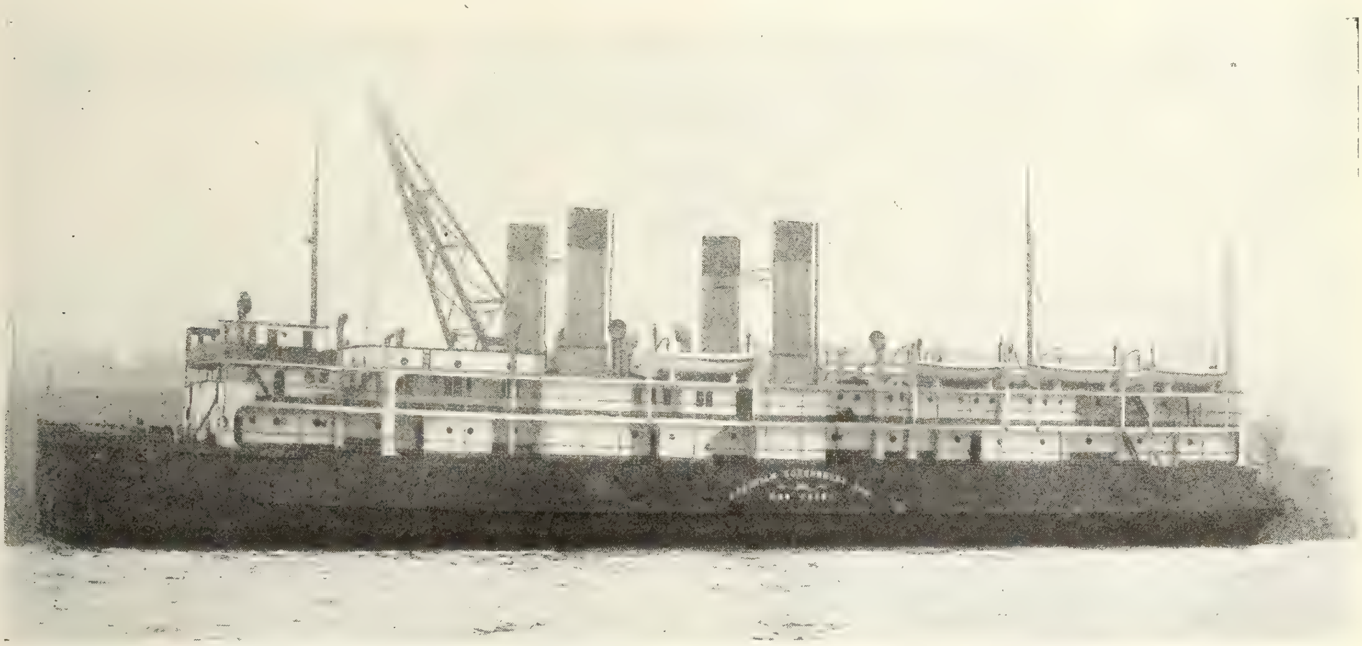
Breakwater and New Harbor

The breakwater, also built by the Roger, Miller Co., is situated to the eastward on a pair and affords protection from the east winds. It is 585 feet long and 110 feet at the bottom, tapering to eighteen feet at the top. Before operations were started there was no harbor, and a new one had to be created. An area of 750,000 square feet was dredged to a depth of twenty feet.

Accommodation Appears Limited

Since the steamer began running, the doubt has been expressed as to whether she will be able to successfully carry on the service with the present accommodation. In the first place the turning basin is too small and too shallow. When loaded down with twelve cars in summer, the steamer draws nineteen feet at the bow and twenty feet at the stern. In winter, in ice-fighting trim, with her water ballast tanks filled, she will draw twenty-one feet, so that with a heavy cargo there will be imminent danger of her running aground.

The contractors urged the Government to have the whole harbor dredged to a depth of twenty-five feet, but the Government did not consider it necessary. However, after the pier had been well got under way and some of the concrete cribs laid, it was decided to deepen the steamer's berth to twenty-five feet. This should have been done before the cribs



ICE-BREAKING CAR FERRY "PRINCE EDWARD ISLAND," AS SHE APPEARS IN SERVICE.

were laid down. The result was that the dredge was unable to get sufficiently close to the berth to deepen all the area required, and the balance of this had to be done by drilling and blasting. Moreover, it has been found that another breakwater 700 feet long will be necessary to afford adequate protection on the west side.

The deepening of the harbor and the building of the breakwater will take at least another year to accomplish. Of course, the steamer will be able to carry on the service after a fashion this season, but she will have to choose her own time in making the trips, in order to take advantage of favorable tides, and it is doubtful whether she can run on schedule time.

Serious Difficulties Feared

Whilst the contractors have done their work according to specifications, there has evidently been a miscalculation by the Railway Department at Ottawa as to the depth of water, and unless the harbor is deepened, some day may find that splendid steamer, costing nearly $750,000, getting into serious difficulties. The steamer has a very small area in which to turn, and in stormy weather it is no small feat to dock successfully. On a recent occasion she was as long docking as she was in making the trip from cape to cape. On other occasions, however, at different stages of the tide and in fine weather she has been docked, loaded and unloaded in twenty-two minutes.

A BIT OF ST. JOHN, N.B., IN 1831.

Fortunately the steamer fits the dock on the island side perfectly. At Cape Tormentine the dock was too small, and it was necessary to strip off sheathing from the fenders and replace them with thinner planks before the boat could enter. Even now it requires all her propellers and her steam winch to get her stern squeezed in.

NOVA SCOTIA AND NEW BRUNSWICK SHIPBUILDING ACTIVITIES

SHIPBUILDING covering a variety type craft may be said to demonstrate a prominent feature of the industrial activity, which meantime is evident in the Maritime Provinces of New Brunswick and Nova Scotia. Steel construction is as yet confined to the plant of the Nova Scotia Steel & Coal Co. at Trenton, near New Glasgow, where two ocean-going freighters, similar in size and design to that already built, are in progress. In this connection it is of special interest to note that the propelling engines of inverted triple expansion type are also being built at the "Scotia" plant; the boilers, however, are being supplied by the John Inglis Co., Toronto. The steel freighter War Wasp, "Scotia's" first venture in the realm of shipbuilding, and recently completed, is propelled by geared steam turbines.

Despite reports some time ago to the contrary, there is no movement on foot to establish a steel shipbuilding plant at Sydney, C.B., by joint Canadian and British interests, notwithstanding the apparently ideal location and other facilities available and the fact that the town council of the city are keen on the proposition, even to the extent of furnishing a handsome bonus. The "Sydneys" and Halifax are, it seems to the writer, finding their business vocation as shipping centres rather than those of shipbuilding, hence the location in both, and in the latter particularly, of numerous ship and engine repair establishments, as well as marine fittings and equipment supply houses, all of which, as might be expected, have their efforts taxed to meet the present abnormal situation.

Wood Ship Construction Prominent

All over the provinces of Nova Scotia and New Brunswick, yards, which were famous in years gone by for their wood ship product, are being rehabilitated and, in not a few favorable locations, new plants have been established and equipped. Wood craft, sailing, auxiliary powered, and regular marine engine equipped, are now under construction from 50 tons up to the standard ocean-going craft ordered by the Imperial Munitions Board, and while the initiation and recreation of the industry has proved to be

SHIP "ROCK TERRACE," 1,769 REGISTERED TONS, BUILT BY DAVID LYNCH, ST. JOHN, N.B., IN 1875. LENGTH, 228 2/10 FEET; BREADTH, 41 2/10 FT.; DEPTH, 25 FT.

a somewhat slow and tedious process, expectations are that by early summer of next year, quite an imposing fleet of commerce carriers will be on active service.

Marine Type Gasoline Engines

The proven value of auxiliary power to fishing boats has created a keen demand for marine type gasoline engines, and quite a few firms report business not only extremely active, but of the greatest promise for the future. The demand is by no means domestic-confined to these specialties, our information being that much of the output is finding its way to the Far East and other neutral and allied countries. Murray & Fraser, of New Glasgow, whose marine gasoline engine we had the opportunity of inspecting recently, are enthusiastically hopeful of the maintenance and development of the maritime markets for their product.

New Brunswick Shipbuilding—Its Past

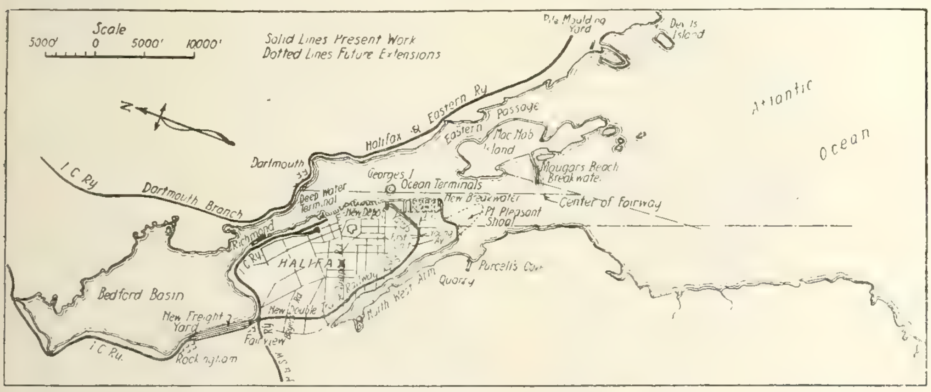
No reference to marine affairs in our Maritime Provinces would be complete without St. John, N.B., being included. Shipbuilding reached its zenith in New Brunswick in 1854, when 135 new vessels of 99,426 tons register were added to the Provincial fleet, most of them being given St. John registry, which at that date showed 582 vessels of 119,965 tons. In 1876, St. John stood fourth on the list of shipowning ports of the world, owning 805 vessels aggregating 280,073 tons. From that date wood shipbuilding began to decline, however, and to such an extent that a year ago there remained on the register but 326 vessels of 38,841 tons. In 1850, the largest wood ship then afloat, the Benjapore, was built in New Brunswick by W. & R. Wright. The ages of steam propulsion and steel construction drove wood shipbuilding to the wall, so to speak, as a result every yard of any pretensions in the Province of New Brunswick was as silent as the grave in 1884.

New Brunswick Shipbuilding—Its Future

The wealth of tradition associated with New Brunswick shipbuilding is never likely to be forgotten, however, with the immediate outlook, the present generations and their successors, are naturally more concerned. Government interest and recognition have not been forthcoming as might have been expected, notwithstanding the effort and activity displayed by the communities interested.

The young general contracting firm of Grant & Horne have gone into the business of wood shipbuilding on the site of one of the old yards at Courtenay Bay, a contract having been secured by them from the Imperial Munitions Board for two steam-driven vessels of 3,000 tons carrying capacity. Good progress is being made with construction, and judging by the success that has attended this partnership in its other enterprises, no hesitation may be felt in saying that their shipbuilding venture will be equally marked.

The St. John Shipbuilding Co., which has been incorporated with a capital of one million dollars, and which numbers on its directorate several prominent Canadian shipping men, proposes to start a yard at St. John, and another at Bathurst. This concern, which intends to engage in the construction of a fleet of small tugs for the Imperial Government, has been delayed in getting to work by the loss of plans which were aboard a torpedoed ship. Duplicate plans have now been received, and expectations are that a definite announcement regarding the start of operations will be made at an early date.



HALIFAX HARBOR, SHOWING LOCATION OF NEW OCEAN TERMINALS FOR CANADIAN GOVERNMENT RAILWAYS.

D. A. Saker & Co. is the name of another wood shipbuilding plant established and being equipped in St. John. It is located on what is known as the Straits Shore. The keel for the first vessel had been laid on the occasion of our visit a month ago and the mill and molding loft erected. Much of the ship timber was also on the ground.

At Moss Glen, 14 miles from St. John, on the Kennebecasis River, Peter McIntyre, of St. John, had a schooner of 425 tons in frames, her principal dimensions being:—Length of keel, 136 ft.; beam, 35 ft.; depth of hold, 12½ ft. About 20 men were at work on this vessel, and, with the exception of a little Southern pine, native woods were being wholly used in her construction.

At Alma, Albert County, C. T. White & Co., lumber merchants, have made a start on a large schooner.

The Rosebank Shipbuilding Co. of Chatham is preparing to construct vessels, and expects to make a start at an early date, while the International Shipbuilding Co., capitalized at $2,000,000, has been incorporated for the purpose of building steel and wood ships at Newcastle. The Eureka Shipbuilding Co., composed of Charlotte County, N.B., men, has been incorporated with a capital stock of $32,000, and has two schooners under construction at Meteghan, N.S.

It may be said that, comparatively, in the Province of Nova Scotia wood shipbuilding was not allowed to languish as in New Brunswick, hence we find the former respond more quickly to the demand for "bottoms," with the result that it is a hive of industry in this respect.

SOME LOCOMOTIVE

PAUL K. WALK, JR., of Charlottesville, Va., sends the following locomotive story, clipped from a Charlottesville paper.

The largest locomotive in the world is in South Africa. It has five acres of grate bars and four acres of netting in the smoke-box. It takes a man one day and a half to walk through one of the cylinders. They have an elevator running up to the head-light, as it takes five barrels of oil to fill it. It takes two men forty-five minutes to light one signal lamp. It takes nine carpenters four months to build the pilot. They have a steam shovel to give her coal.

The tank holds 27 carloads of coal. Every time the engine exhausts it rains for twenty minutes. The engineer uses the X-Rays to look out for signals, and goes blind after running for six months. It takes two astronomers with powerful telescopes to see her going.

The pony wheels are the size of turntables in this country. Monster trees of the forest have been knocked down by the wind of the train. She runs from Kimberley to Johannesburg—a distance of 900 miles—in three hours and eleven minutes, and hauls seven hundred and twenty-two cars.

The round-house force hold a picnic in her fire box every summer. When they wash the boiler it is necessary to drain the Suez Canal. She carries 860 lbs. of air on train line. The throttle is pulled by a stationary engine in the cab. The lubricator holds four barrels of oil.

When she leaves the rail, there is an earthquake in China four days later.

The train runs so fast, that when she stops she is still going ten miles an hour.

The glare of the head-light can be seen through a hill half a mile thick. When she takes water she dries up an ordinary river, and lowers the water level of the ocean several feet.

The story bears the signature of Chas. H. Fletcher.

Captain George S. Laing, 56 Yorkville Avenue, Toronto, who represents The Imperial Merchant Service Guild, Liverpool, England, in the capacity of honorary Canadian agent, is to lecture in various towns and cities of the Dominion during the winter on "Our Merchant Navy in Peace and War," depicting by means of 150 lantern slides, the many-sided activities of this important arm of our national service.

Steam Saving Auxiliaries of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that steam-saving auxiliaries aboard ship continue to increase in number, and that they are being designed and constructed to meet, in the most effective manner, both ordinary and special service applications, this series of articles describing and illustrating at least the more important types of such apparatus seems to us more or less timely, both from the point of view of familiarizing engine and boiler room staffs with the products of different manufacturers, and that of their acquiring a closer intimacy with specific detail arrangement, relative to operation, maintenance and periodic overhaul.

STEAM SEPARATORS—1.

WET steam is probably the most troublesome feature of steam power plant operation with which engineers have to contend. Not only is it dangerous through giving rise to water hammer with breakdowns and occasional loss of life, but all the time it is a source of continual loss in the efficiency at which a plant operates. Even though the steam as it leaves the boiler is comparatively free from moisture, it has been found as a result of investigations that about 3 per cent. of water is nearly always present in the steam as it enters the engine, and that in some cases it may exceed 50 per cent., part of this being water carried over from the boiler and part due to condensation.

Causes of Wet Steam

Various conditions are responsible for the presence of water in steam, chief of these being priming of the boiler, and excessive condensation in the pipe line. In the case of the boiler, a small percentage of water is always present in the steam unless the rate of evaporation is extremely low; rapid steaming boilers being much more prone to priming than the less modern cylindrical types with or without tubes, although any sudden reduction of pressure is liable to cause priming despite the provision of large steam-liberating surface and water-carrying capacity. In any case, a proportion of solid water may enter the pipe line along with the steam, forming a slug, which is carried along with the steam at a high velocity until it reaches the engine after which something unfortunate is liable to happen.

Under normal conditions, an uncovered steam pipe will condense fully three-quarters of a pound of steam per hour for each square foot of surface. Properly covered pipes reduce this to a great extent but are unable to prevent a degree of condensation sufficient to saturate the steam so that a serious loss of efficiency is unavoidable in any engine working under these conditions, unless the moisture and water be almost entirely removed from the steam. Even where the principle on which a separator works may not be quite correct, its value is frequently increased by the provision of a receiver of suitable volume which not only gives the moisture an opportunity to settle by gravity, but also cushions the pulsations of the steam in the pipe caused by the opening and closing of the valve in the engine cylinder.

Necessity for Separators

The detrimental effect of wet steam on cylinder lubrication in piston engines, and on the blades of steam turbines has been proven frequently and the economy of oil and upkeep in both types of prime movers is sufficient in many cases to justify the installation of a steam separator. When to these features is added that of freedom from breakdown due to water hammer, the vital necessity of an efficient steam separator becomes more and more apparent.

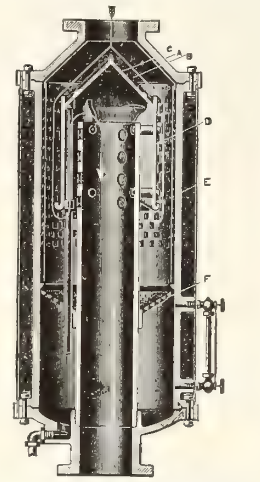


FIG. 1. VERTICAL STYLE SWEET'S SEPARATOR.

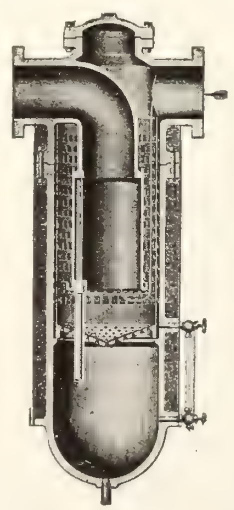


FIG. 2. HORIZONTAL STYLE SWEET'S SEPARATOR.

The recognized standard of efficiency for a steam separator is the ability to separate not less than 99.5 per cent. of moisture from steam depending upon circumstances, good modern practice enabling higher results to be obtained. Other features deserving consideration are, the minimum reduction of pressure in currents passing through the separator, simplicity and durability of construction, compactness, and suitabilit for operation under high pressures.

Sweet's Separator

The design of this separator is based on the fact that water may be removed from steam by passing the steam over a corrugated or rough surface, to which the little particles of water adhere. The surface employed is broken up in such a manner that the little particles are immediately conducted out of the steam current, and kept from further contact with it. The capillary principle, which is the foundation of the design, is most efficiently employed when the surface is at a maximum, and the various types of Sweet's Separator, as built by the Direct Separator Co., Syracuse, N.Y., are provided with liberal separating surface and large space for steam storage and water chamber, the latter feature making it of value as a steam receiver to prevent vibration etc.

The vertical type is illustrated in Fig. 1. The accumulated moisture around the walls of the steam pipe is caught by the upper edge of cone A and carried down back of a lining to the water chamber. The current of steam entering the separator impinges upon the conical surface composed of solid plate C covered with sieve B, through which water may freely pass, but from which it cannot readily escape. Passing through the sieve and depositing on the solid surface of the cone C this water is carried by conductors to the water chambers. By means of the cone the column of steam is changed to an annular ring, which is comparatively thin even while the full area of the pipe is maintained. The steam upon the outside of this ring comes in contact with the lining of the shell, which is a sieve of the same character as at B, and which catches and entrains any water which may be contained in that portion of the current. There is also provided a trough at lower edge of inverted cup, which leads all the water that may adhere to its surface down to the conductors to the water chamber. The current of steam passes through the passages in-

dicated by the white lines, and is subjected to a whip-snapping action which will throw off any moisture that has not been caught by the surface over which it has passed. The diaphragm F pre-

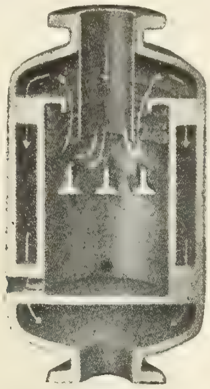


FIG 3. WEBSTER VERTICAL SEPARATOR SHOWING BAFFLES AND GROOVES.

vents the steam from picking any water out of the water chamber.

The horizontal separator, Fig. 2, operates in substantially the same manner as the vertical style, the moisture on the bottom of the inlet pipe being caught by the shelf and cone provided,

FIG. 5. HOPPES VERTICAL SEPARATOR, SHOWING CONE AND INTERCEPTING TROUGHS.

from which it finds its way to the back of the lining and to the water chamber the moisture adhering to the elbow passes over its surface and is caught by the trough provided, whence it passes through conductors to the water space. The steam then passes in an annular ring through the space indicated by white lines and is acted upon the same as in the vertical style.

In the smaller sizes, the separating plates are made of copper, and in the larger sizes a special non-corrosive sheet iron is used. The smallest size made weighs 50 lbs., and the largest 24,000 lbs.

Webster Separators

Eleven different styles of these separators are built by Darling Bros., Montreal, the wide variety enabling piping and pressure conditions to be conveniently met in installations of all kinds. The standard types are also modified to form receiver separators which provide receiver wells of unusual dimensions to receive large slugs of water from excessive boiler priming or unusual condensation in low-pressure service and also tend to equalize steam pressures at the point of delivery because of the large quantities of steam which they store.

Cast iron shells are used in all of the standard types, of which the vertical and horizontal designs are illustrated in Figs. 3 and 4 respectively. In the former, the steam is directed into a central space which reduces the velocity considerably to assist in separation, the cast iron baffles which extend across this space causing a sudden change of direction of flow with consequent freeing of entrained moisture. The upper walls of the central space are provided with sloping grooves which complete the process of separation as the steam passes over them on its way to the outlet at the lower end.

The horizontal separator, Fig. 4, is provided with a central baffle plate with collecting ribs on the face against which the steam impinges, the moisture dropping from the ribs into the collecting space below. The lower ends of the ribs are connected to a diaphragm which prevents free passage of the of the steam below the baffle, suitable spaces around the sides and top being provided for the passage of the steam.

Hoppes Separator

This apparatus has been designed on the principle of reduced steam velocity with a complete absence of tortuous passages, baffles, abrupt reversals of direction etc. To accomplish this object the inlet passage is gradually enlarged into the expanding chamber where the water is deposited, being then gradually reduced to the capacity of the steam

FIG. 4. HORIZONTAL TYPE OF WEBSTER SEPARATOR WITH VERTICAL RIBBED BAFFLE.

pipe; the working areas nowhere are less than three and one-half times the area of the pipe.

The vertical type is shown in Fig. 5 from which it will be seen that no obstructions to the free flow of the steam are offered, nor are there any edges

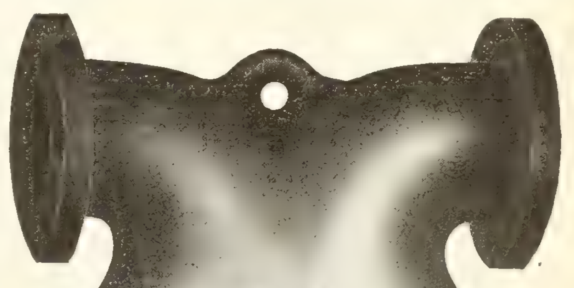


FIG. 6. HOPPES HORIZONTAL SEPARATOR WITH SEPARATE TROUGHS TO EACH PASSAGE.

from which the water of entrainment can be blown off and atomized. The entrainment follows the surface to the

lowest part where it is intercepted by water in the bottom. Water which strikes the cone on entering is also collected in a trough, partly filled with water, being then carried to the bottom by the pipe shown. The dry steam

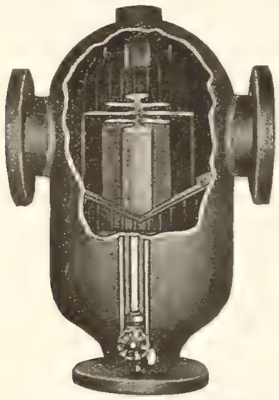


FIG. 7. SMART-TURNER SEPARATOR WITH CENTRE BAFFLE AND GROOVED WALLS.

escapes through the upper end of the outlet pipe which projects up underneath the cone.

The horizontal separator Fig. 6, is so designed that the steam may flow through it in either direction. The inlet and outlet ports are separated by a vertical division plate which extends down to where separate gutters surround the inlet and outlet passages. These are partly filled with water to intercept all water of entrainment fol-

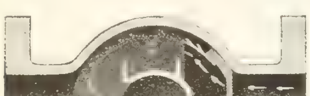


FIG. 8. HORIZONTAL STRONG SEPARATOR SHOWING LIP FOR TRAPPING CONDENSATION.

lowing the surface, while the downward plunge of the steam entering the steam chamber throws the water of saturation to the bottom of the separator. The excess water is carried from the troughs by pipes to the bottom of the separators from which it is trapped in the usual way.

These separators are built by the Hoppes Mfg. Co., Springfield, O., in sizes from 1 in. to 9 in. inclusive and suitable for working pressures of 200 lbs. per sq. in.

Smart-Turner Separator

This apparatus is of the impact baffle type, in which change of direction along with collecting surfaces is relied upon to extract the contained moisture. It is of the horizontal type, suited for use in either direction (see Fig. 7). The steam inlet opens directly into an expansion space, in which is placed a ribbed baffle plate, supported on a gutter-shaped division plate extending across the space. After impinging on the baffle and depositing moisture, the steam passes over and around, thus coming in contact with a suspended baffle on top, and numerous vertical ribs or grooves formed on the side walls in such a way as to carry the collected moisture down past the division plate into the collecting well, from whence it is drained by trap in the usual way.

These separators are built by the Smart-Turner Machine Co., Hamilton, Ont., in sizes from 2 in. to 12 in.

Strong Separators

The horizontal and vertical types of this device are shown in Figs. 8 and 9, special attention having been given to providing means for removing the water of condensation, which in the case of long horizontal pipes sometimes assumes a large volume running along the bottom of the pipe. The separator is, therefore, so constructed that it does not throw together the condensed steam and entrained moisture. As shown in Fig. 8, the stream of water is caught by a projection from the cage, and is at once conveyed to the well without being mixed with the steam. The entrained water goes with the steam around the inner pipe, and is thrown by centrifugal force against the surrounding perforated copper sheet, through which it can readily pass, but through which it cannot return.

In passing around the inner pipe, the shape of the current of steam is changed from a circular to a narrow rectangular one, and is also subjected to a whip-snapping action, which throws off any moisture left in the steam. A metal ring at the bottom of the separating cage prevents the steam from picking up any water from the water chamber.

In the vertical type, Fig. 9, the water coming in with the steam is caught in the upper chamber and carried by the pipe shown to the water chamber, the remaining action being the same as in the horizontal type. These separators are built by the Strong, Carlisle & Hammond Co., Cleveland, O., in sizes from 3 in. to 12 in., both types being built in two sections, the lower one acting simply as a water collecting chamber. When a receiver type of separator is desired, it is furnished of any required dimensions by enlarging the water chamber.

W. & McD. Combine Separator

In these separators, use has been made of four methods of separation; viz., expansion, reverse of current, centrifugal force and baffle plates. These accepted mediums are combined in a suitable

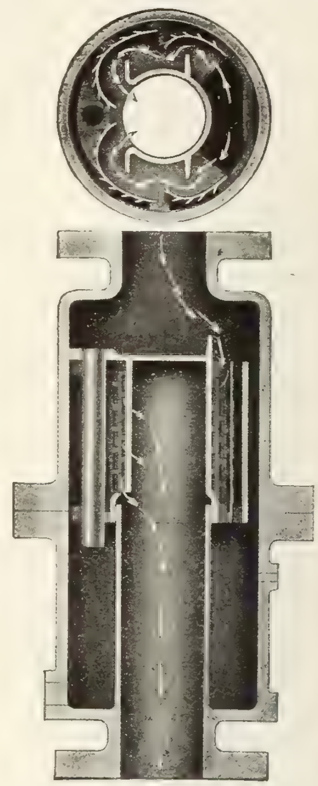


FIG .9. VERTICAL STRONG SEPARATOR WITH LIP ON TOP AND DRAIN PIPE TO WELL.

manner so as to give desired results in separating entrained water from steam. The steam enters as shown, the increased volume of the chamber reducing the velocity so that the heavier particles fall out by gravity.

By placing the mouth of the inlet pipe in the position shown, the steam is

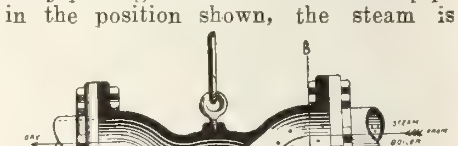


FIG. 10.

caused to reverse its current, and also assume a whirling movement, the separating effect of which is further enhanced by a series of baffle plates placed in a circular position radiating toward the

centre in the path of the steam. These form an obstructing surface for all non-elastic substances to impinge against and be precipitated to the well of the separator for removal by trap.

These separators are built by Watson & McDaniel Co., Philadelphia, in sizes from 2 in. to 9 in. for a working pressure of 125 lbs. per sq. in., in cast iron. Sizes from 10 in. to 20 in. are built entirely of steel plate.

POWER LOSS IN SCREW PROPELLERS

EXPERIMENTS described in a paper by Naval Constructor William M'Entee, U.S.N., at the recent annual meeting of the Society of Naval Architects and Marine Engineers, indicate that a great saving of power is effected when ship propellers are made of some non-corrodible metal like bronze and are carefully machined and polished, as compared with the common practice of using propeller castings as they come from the foundry. It is likely that these experiments teach a valuable lesson, also, to the designers and builders of centrifugal pumps. The skin-friction of a rapidly moving impeller in a centrifugal pump must be very great, especially in pumps working at high heads; and it seems all but certain that this skin-friction must be greatly increased if the impeller is a rough casting.

Usually, screw propellers used on naval vessels are carefully finished by machining the rear surface of the blade to a true helicoidal surface and finishing by hand the front face so that it will be perfectly smooth. The propellers of merchant vessels, however, generally have blades of cast iron or cast steel, and are given no finish whatever, except trimming off the rough places with chisel or file. In addition as is well known, iron and steel propellers often suffer by pitting, so that they present an extremely rough surface to the water.

With the object of determining the relative efficiency of a smooth-finished propeller and a propeller left with the rough surfaces of the original casting, four propellers, 16 inches in diameter, were tested at a uniform speed of 5 knots. Two of the propellers were of bronze, one of cast iron, and one of cast steel. One of the bronze propellers was finished perfectly smooth; the others were left as they came from the mould, with only the ordinary cleaning. The test showed that the propellers with a rough surface had a maximum efficiency of about 63 per cent., whereas the polished propeller had an efficiency of about 72 per cent.

Another test was made to determine the effect of a still rougher surface, such as exists on a propeller that becomes badly pitted or on which barnacles and other sea growths accumulate, by varnishing the polished bronze propeller and applying to the sticky varnish a layer of granulated cork, such as is used for cork paint in ship work. The efficiency of the artificially roughened propeller, which had been about 72 per cent. in its polished condition, was reduced to 36 per cent.

FIRST BRITISH STANDARDIZED SHIP PASSES TESTS

ACCORDING to recent advices, the first of the standardized ships built to the order of the British Government has completed her final tests and been put into commission as a cargo carrier for the nation. In every respect the trial proved an unqualified success. It was of a most exhaustive and comprehensive nature, and the experts who were on board during the inaugural trip were unanimous in their praise of the vessel, which marks a new epoch in the maritime history of the Empire, and which may be destined to play an important part in the campaign against enemy submarines.

Objects of Type

The standardized ship has been designed with the idea of providing a good type of cargo carrier in the shortest possible time, with the minimum expenditure of material, having regard to war conditions, which involves the question of the speed of the ship. The keel was laid in February this year, and in August —less than the full six months—the vessel was fully loaded and ready to go to sea. She is the first of the series of standardized ships, but actually there are two types of vessels, of 8,000 tons deadweight carrying capacity. These are classified "A" and "B" types, the first-named being single-deck ships and the others two-deck ships. This ship is of the "A" class. It is also intended to construct two smaller types—one known as class "C"—and these ships will be 5,000 tons deadweight each; and class "D," all of which will be 3,000 tons deadweight. In addition, however, other types are under consideration at present.

All the principal shipbuilders in the United Kingdom are busily engaged on the construction of standardized ships, and, while the number on hand need not be stated, the total output will be very substantial. The vessels are being constructed under the supervision of the classification societies—Lloyd's Register, British Corporation and the Bureau Veritas—all of which are really collaborating for this purpose. As in the case of the hull, the machinery and engines are all standardized, so that the first engine goes into the hull complete. This is an obvious advantage of the first order, as not infrequently it has been the experience of builders to wait some considerable time for the installation of the machinery. Engines and machinery, of course, lend themselves more readily to standardization than the ship itself, as variations occur in the construction of the vessel owing to the different facilities in the respective yards.

Economy and Comfort

On the question of speed it may be added that special attention has been devoted to this important aspect with a view to securing the maximum number of knots for the service in which the vessel is intended to trade. A feature of the general arrangements and equipment is provided in the very large hatchways, making the ship almost practically self-trimming, and immensely facilitating the loading and discharging of the ship. In fact, the central idea is that such steamers should be not only built quickly, but capable of being worked speedily. Thus the standardized ship represents a long advance on the way towards producing "a poor man's ship," as it can be run on the most economical lines, everything possible having been simplified. Admittedly, there are no "frillings" on the standardized ship. But the essential and paramount question of efficiency has not been overlooked. In the words of the experts, "it will be a very efficient cargo carrier," and there should not be the slightest difficulty in selling such vessels to any private owner after the war.

An important point—and one upon which there will be widespread interest —is that of the accommodation provided for the crew. This question, too, engaged the closest attention, with the result that it will be generally admitted that the provision made marks a big advance upon the men's quarters in ordinary cargo steamers, and particularly of the "tramp" class. The crew are berthed aft in the poop, instead of the forecastle, as has been the general rule hitherto, and separate cubicles are provided, each fitted with two berths. Messing arrangements are entirely separated from the sleeping accommodation; a smoke room is provided for general use, and special arrangements are made for steam-heating in the men's quarters.

SMOKE BOXES FOR MERCHANT VESSELS

A RECENT issue of the "Hydrographic Bulletin" announces that the Bureau of Ordnance of the Navy Department at Washington has arranged for the supply of smoke boxes for merchant ships desirous of being equipped with them. The cost is approximately: smoke funnel, $125.00; smoke box, $25.00; phosphorus, $1.75 per lb. The smoke funnel is for the production of smoke on board the vessel and requires only the fuel for its continued use. The boxes are for throwing overboard and once used cannot be recovered. The Navy Department has announced as its policy that smoke-producing apparatus for the use of merchant vessels should be available for every vessel desiring to purchase same.

AT the Kawasaki Dockyard, at Kobe, a 9,000-ton steamer, complete with engines and masts on board, built for British owners, was recently launched in two months twenty-seven days from the laying of the keel. Within ten days of being launched her trials took place. Seven more steamers, of 9,000 tons deadweight each, are at present under construction at the same yard.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

THE RETURN OF NEPTUNE

By Capt. Geo. S. Laing

THE allegorical saint of the sea has actually thrown his signal halyards over Toronto. We knew that his spirit had entered the building yards of Canada, where men are feverishly hammering vessels together, but to think that the old man with his oakum whiskers and boat-hook mace should come up the St. Lawrence and hail the Province of Ontario with: "I want boys for the sea" comes altogether as a surprise.

Those who have never studied the lines of thought and action that radiate from nautical matters cannot be expected to see at first glance the vast importance of keeping up a Royal and Merchant Navy. It wouldn't be hard to find a few men in high places of national service who cannot understand the cry for ships, and the call for boys and men to sail them.

Some will say, "What does Canada want with ships apart from her lake-boats? Have we not a vast country here, from the Great Lakes to the Pole and from the Atlantic to the Pacific?" True brother, but unless you want to become commercially backward like China and Russia in proportion to their area and population, then you must build and man your own Canadian ships of war and commerce.

Nearly three-fourths of the globe is covered by sea and ocean, and the present war has told us in hard lessons of experience that interdependence is a big factor among the nations that count.

Some will say, "How did Canada get along without ships till the present time?" Simply because she trusted to Norwegian vessels on her coasts, and to the royal and merchant fleets of the Mother Country for her ocean protection and trade. Just imagine how far down Canada was in marine matters when she actually handed over her coastwise trade to a foreign power. The writer is only of middle age and while he has seen Nova Scotian barques in Cape Town, Adelaide, Valparaiso and Rio de Janeiro, they were almost curios of a once flourishing Canadian merchant marine.

Within the last twelve months we have noticed with pride that Canadian shipyards (many of which have come up like the proverbial mushroom) are building vessels and chartering them to the far-off ports of the world, and therein lies Canada's safety—national and commercial.

TORONTO BOYS' NAVAL BRIGADE TRAINING SHIP "COMMODORE JARVIS"—PROFILE.

Now to use the most powerful illustration of all: "What are Germany and Austria fighting for?" I tell you it is the SEA. The mighty sea that divides continents. The sea that in depth could swallow Mt. Everest and shout for more. The sea that bore the world's explorers away to the unknown. The sea that brought sailors back with charts of new lands, accounts of strange races, and samples of foreign merchandise. The sea is and always will be the greatest commercial medium and educator of the world. Why do I say educator? Because the sea has developed men's genius and their spirit of adventure.

Have men like Darwin, Scott, Brassey, Stevenson, Bullen, Cook, Lecky, etc. given nothing to science? All these men and their class have scoured the seas. An Irishman never grows to mental maturity in Ireland, he must set sail for abroad. Then take into account the problems of the sea with which we find men—great men—grappling. For instance, ship-building in its complexity, cable laying, light-house, breakwater and canal building, marine engineering—one word alone that commands armies of skilled mechanics and men who invent, draw up and work out miracles with steam, electricity etc. Thus we find that the sea draws men to it who have great ambition and persevering ingenuity.

The Phoenicians and Romans knew what sea power meant, even in galley days. Again in much later times the

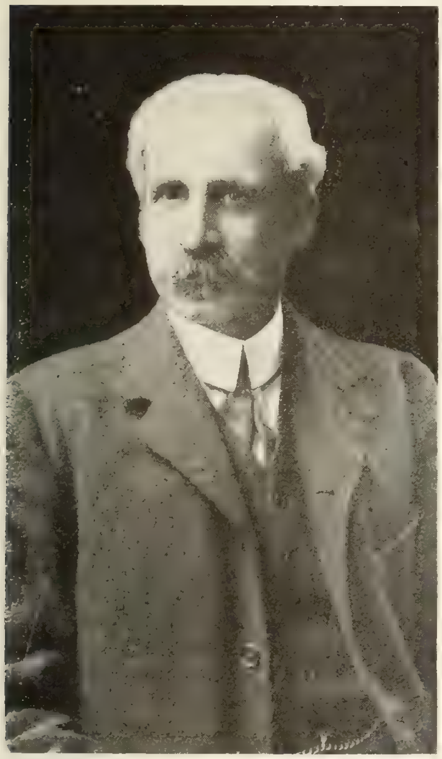
RECEPTION TO THE BOYS OF H.M.C.C. "NIOBE" AT R.C.Y.C., TORONTO, JUNE 27, 1917.

Spaniards, Portuguese and Dutch rolled in glory while they held the sea and invested in shipping. These nations have all gone astern from the hour that Neptune forsook them.

Further, does the sea question interest Canada's wheat provinces? Well it ought to; railway transportation alone would never sell the wheat of the West —no sir, not on your granmother's sunbonnet. The Westerner would go down and out if his product never saw a ship's hold.

One more crack of the whip: Why do European neutral nations in this conflict allow the Hun pirates to sink their merchantmen, and just protest on paper? Reader, these nations have no alternative. They are as kittens, because they possess no fighting fleets to speak of, so their trading vessels must take a chance right up to the last minute. Again, the economic conditions that are woven into the national fabric of these countries are reared on SEA transportation. The Scandinavian countries and Holland would send men to sea on rafts if their last ship was torpedoed.

TORONTO BOYS' NAVAL BRIGADE TRAINING SHIP "COMMODORE JARVIS"—BOW ON.



COMMODORE ÆMILIUS JARVIS, S.S.D., President Navy League, Hon. Pres. Toronto Boys' Naval Brigade, Chief Naval Recruiting Officer, Ontario Province.

Although Germany has committed marine suicide, she will stick to her "blood and guts" seamanship until its undercurrent chokes her, or till she loses the Flemish coast.

The nation which can hold and control ocean and coastwise shipping will win the war. After the war is over the nations who can handle their own exports and imports will go ahead in industrial prosperity. Countries that lack tonnage will stop dead for two decades.

Think of Russia, France, Italy, China, India, Australia, Spain, etc., the governing heads of all these nations are begging and borrowing tonnage—ships—from the British Isles. That is why a great part of Britain's war work consists in producing vessels. The yards of the Clyde, Belfast, Tyne, Tees, Dee, Wear, Thames, Mersey, and so on, are all hammering steel into floating material—which is the bulwark of our Empire. The ship-building fever has even entered the North American continent, and not before time, for Uncle Sam and Jack Canuck must do some of their own sailorizing or a nations they will drift to leeward.

In this connection we are fortunate in having in our midst a man of the Aemilius Jarvis type, who through his indefatigable effort and personal service has expounded the great value of, and need for, ships of war and commerce, with men and boys to operate them.

The most recent expression of Commodore A. Jarvis's love for ships and sailors comes to us through the medium of the Toronto Naval League, where his name appears as Hon. President. This league in its own words "exists to provide equal facilities for fostering the sea-going instinct among the sons of the poor and the sons of the well-to-do. The

GROUP OF BOYS ABOARD TRAINING SHIP.

BOYS MARCHING TO WHARF TO PARTICIPATE IN TRAINING SHIP INAUGURATION CEREMONY.

Canadian marine, naval and mercantile, needs recruits and has needed recruits for a generation."

Mark you, this organization does not quit when the war stops, its work must go on for ever in turning out young, healthy boy material to sail the ships of Canada—the vessels we are building now and those that we must build and man in the future.

At the present moment the crews of our lake-boats (we haven't any coast or ocean fleet to speak of), are largely nondescript. In other words there is no proper training for boys or youths who sail as deck hands, lookoutmen, and wheelsmen. The bulk of mates and masters are recruited from these ratings nevertheless.

Will all the boys of the Toronto Naval League aspire to become seamen and navigators? No, but those who don't will have the marine spirit and elementary knowledge and ambition that may steer them into ship-building—a word so complex that it almost covers all the handicrafts known to man. Should Toronto ever be lucky enough to become a port for direct ocean traffic, as Montreal is now, the wisdom of having the Naval League as a national asset will be more than demonstrated, and it is almost certain that, before another year has gone by, Canadian ship-owners and builders will fully endorse the institution with something more tangible than favourable comments, and be quite pleased to welcome the boy graduates as deck-hands, wheelsmen, cabin boys and apprentice seamen.

Without a doubt many of our future captains and officers and engineers under the Canadian flag will look back with gratitude to the league that put the vim of the ocean and love of sea adventure into their plastic minds.

The enthusiastic President of the League is the Rev. J. Russel MacLean, Rector, St. John's Church, Portland St., Toronto. A very good anchor in the moorings of this young mariner's club is the fact that it works in conjunction with the church—not a church but all churches. Who dare say that we have no Drakes, Nelsons, Shackletons, etc. in the budding?

The cuts shown herewith speak for themselves and lead up to the fact that the Toronto Naval League means to have the practical equipment of a first class training ship right at our doors, where sea practice as well as sentiment will be taught by experienced shellbacks, who can work a reef cringle into the after-leech of a staysail, choke the luff of a gun-tackle or beach a lifeboat.

The anchor lights of the Toronto Naval League send out their rays of invitation from Headquarters, Jarvis Bldg., 103 Bay St., Toronto.

Father Neptune, our allegorical saint, has again reached our shores. May he enroll thousands of "jolly sailor boys" and meet them at his great initiation grounds—the equator.

HANDY SPRING SAFETY VALVE CHART

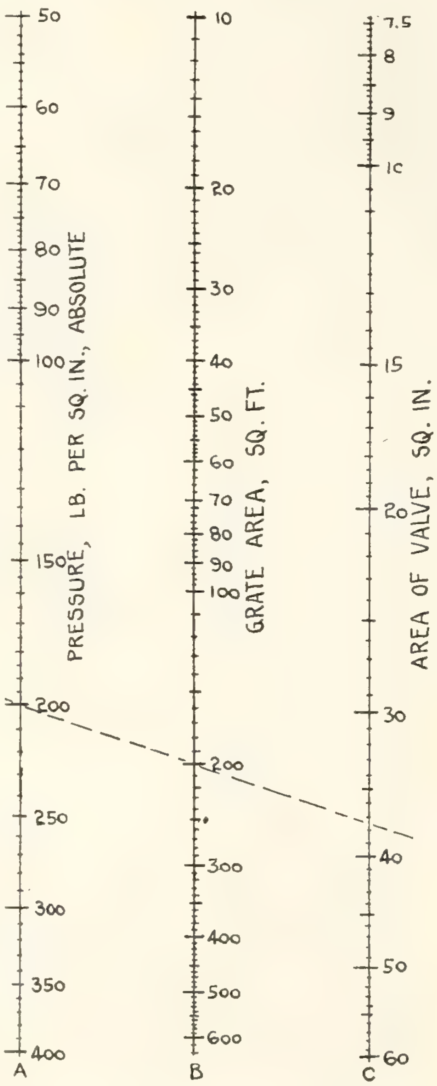
By N. G. Near.

THIS straight line computing chart is based upon the well-known British Board of Trade formula for spring safety valves:

$$A = \frac{37.5\ G}{p}$$

where A=area of valve in sq. in.;
where G=grate area in sq. ft.;
where p=steam pressure in lb. per sq. in. absolute.

As is well known by most marine and locomotive engineers, lever safety valves are impractical on locomotives or on shipboard because of the vibrating or oscillating movement, and for that reason spring loaded valves are used entirely. In marine service two duplicate



HANDY SPRING SAFETY VALVE CHART.

valves are required by the Board of Trade. The diameter of the valve, also, must be 2 inches or more, while the maximum lift of the valve must be at least one-fourth of the diameter. Well, this chart is based on the formula given above. To use the chart simply lay a straight edge across once as indicated by the dotted line and the answer is immediately found in column C.

For example—If the grate area is 200 sq. ft. and the steam pressure is 200 lb. per sq. in. absolute, what must be the area of the valve?

Connect the 200 (column A) with the 200 (column B) and the extension of the line through column C shows the answer to be 37.5 sq. inches. The dotted line drawn across this chart shows how the problem is solved.

Again, the chart may be used "backwards" very nicely for determining grate area or pressure when the valve area is known. Simply swing the straight edge around the area as a pivot and the intersections with columns A and B give the corresponding pressure and grate area for any pivotal position.

The range of the chart, I believe, is wide enough to cover the needs of nearly every marine or locomotive engineer. It includes all pressures from 50 to 400 lbs. per sq. in. and grate areas from 10 to 600 sq. ft.

IS THERE TOO MUCH STEEL IN SHIPS?

By T. J.

THERE are many people who in these days think that there is too much steel in ships of all kinds, and they may be interested in some remarks which were made by the late Sir William White at a meeting of the Institution of Naval Architects in 1911. He said that in his judgment the margins which were often taken in merchant ship construction were frequently excessive. After allowing fully for the different and difficult conditions under which many classes of merchant ships had to work, he was convinced that in certain classes of vessels a closer approximation might be made with safety to the scantlings and methods of construction which had proved so successful in war ships for long periods, and that much weight might be saved whilst ample strength was provided.

In warship construction they necessarily employed very light scantlings, and the provision of sufficient local strength was often the governing factor in limiting scantlings. Warship builders believed that their proper course was to get from the steel makers beams and bars of sectional forms which would enable them to associate in the best way lightness with strength, and to reduce the work of "building-up" the sections required. The progress of steel manufacture had brought to mercantile shipbuilders the power of getting sections such as were then quite out of the question in the days of iron because of the great cost of special sections. In ships built for the Admiralty service, prices were paid which no private ship-owners would then have looked at. The difficulty had now been surmounted, thanks to the development of steel manufacture, and warships as well as merchant ships had, in that respect, come together more closely than was formerly the case.

But, broadly speaking, he was still of

the opinion that, in regard to shell-plating, deck-plating and bulkheads as well as many other portions of structures, there was no real necessity for such marked differences between warships and merchant ships as still existed in practice. Of course, if a mercantile ship has to take the ground frequently, her framing and bottom plating must be different from those of warships, which are intended to be kept afloat. Merchant ships, also, had to carry large, heavy localized cargoes and this involved special precautions. After allowing for essential differences in conditions of service, however, great benefit might, in his opinion, be derived from a study of the experience gained with warships throughout the world. Designers and builders of merchant ships might safely avail themselves of this experience and that would be true both in regard to considerations of general strength and of local strength.

FIXING A BALKY VALVE

By J. Haliburton

SOME time ago I was asked to fix a balky hand force pump of the type in which valves are made as in Fig. 1, the same piece of leather serving both as gasket and as valve flap. On one side of the flap there was a brass plate covering most of the said flap and held in leather and screwing into the plate. The head of this screw was broad, yet thin, and was slotted for a screwdriver. Of the three of these valves in the pump not one of them seated pro-

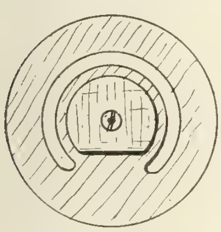


FIG. 1.

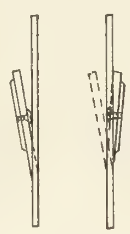


FIG. 2.

OVERCOMING TROUBLE WITH HAND FORCE PUMP VALVE.

perly, because the leather had acquired a "set" in a shape that kept the flap sticking up, as shown in Fig. 2.

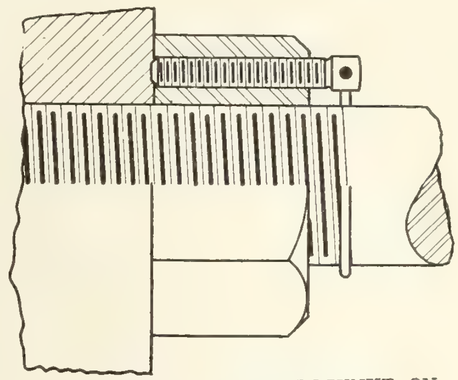
By removing the leathers from the pump, taking the screw out, and putting the plate and screw each on the opposite side of the leather from what they had been before, and then putting the leathers back into the pump other side up from what they formerly were, I secured the aid of this "set" in the leather to help hold the valve to its seat. After treating each valve in this manner, and priming the pump, it held water O.K., and worked satisfactorily right along although the less drastic remedies previously applied had proved unsuccessful.

FASTENING SCREWS AND NUTS

By A. L. Loy.

CONSIDERABLE trouble had been experienced with the nuts on the piston rods of gas engines working loose. These nuts were used as lock nuts on the rod where it entered the crosshead. Tightening up the nut draws the threads on the rod to the back of those in the head, so that the pressure of the explosions comes directly on the nut. Should the nut become loosened only slightly, the small movement of the rod in the head will soon work the nut back, and either cause the piston to unscrew or, as sometimes happens, the piston rod is forced through the crosshead, tearing out the threads.

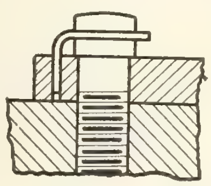
The nuts were drilled and tapped and the cup point set screws tightened against the crosshead after the main nut was tightly drawn up. Holes were drilled through the head of the cap screw and a wire was run through and then wrapped



METHOD OF FASTENING LOCKNUT ON BACK OF CROSSHEAD.

around the rod and the ends fastened together. Since the screw would cut into the metal of the crosshead a certain amount, it would have to back out this amount before the main nut could move and the wire very effectively insured that these parts would remain tight.

A wire may also be used very satisfactorily in the locking of cap screws, as shown in the cut. Holes are drilled through the heads of the screws, and also down into the piece being held by the screw, as close to the screw as convenient. The wire is pushed down into the hole and then pulled through the



LOCKING CAP SCREW WITH WIRE.

head of the screw and cut off. It is immaterial whether the holes line up, as the wire will simply be bent to correspond and cannot come out unless deliberately removed.

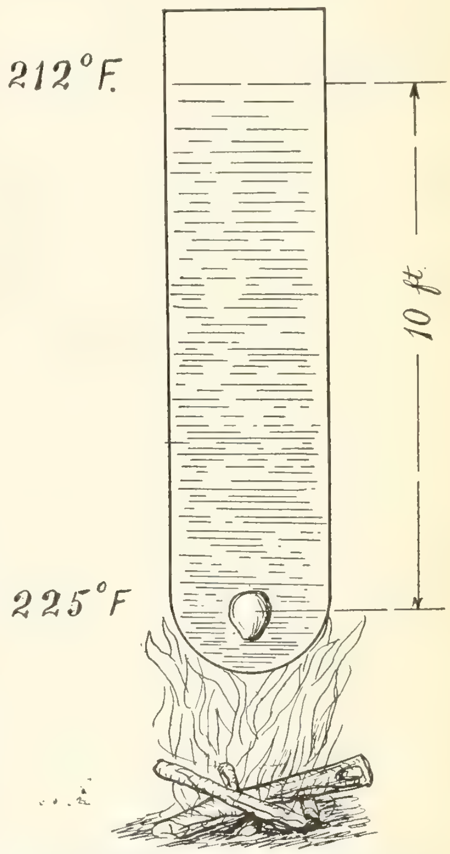
WHAT IS THE TEMPERATURE OF A STEAM BUBBLE?

By N. G. Near.

IT is generally assumed that the temperature of the water in a steam boiler is practically uniform from top to bottom, but it occurs to the writer that in some of our modern boilers there may be a considerable difference, especially in the steam temperature.

It is often explained that in the generation of steam, small steam bubbles form at the bottom of the boiler, whether tubes or shell, and that these bubbles then shoot upwards because of their low density. However, according to steam tables, the temperature of a steam bubble at the bottom of a large boiler must be sometimes as much as 20 deg. F. higher than the temperature of the steam in the steam chamber.

Take the example shown herewith—a vertical tube holding 10 feet of water.



ILLUSTRATING REMARKS ON TEMPERATURE OF STEAM BUBBLE.

The water pressure at the bottom is 4.34 pounds per sq. in., or 19 lbs. absolute. The temperature of steam under such a pressure must be at least 225 deg. F. The top of this tube being open to the atmosphere, the temperature of the steam escaping would therefore be 212 deg. F. at sea level. Hence we have a difference in steam temperature of 13 deg. F. The small round object drawn at the bottom of the tube is a "steam bubble."

One of the best stories concerning British weather is related by the Bishop of Lydda. "Once, before I was bishop, I was on the top of an omnibus where were seated some Parsees," related his Lordship. "A man said to me, 'What are they?' I replied, 'Indians—Parsees, you know. Men who worship the sun.' And the man replied, 'Oh, I see, and they have come over here for a holiday.' "

COMMUTATOR TROUBLES

By A. V. Burr.

ELECTRICAL machines of the commutator type should be given close attention by the operator, especially in regard to the proper operation of the commutator and brushes. It is here that any faults of the machine usually manifest themselves, and any unusual symptoms of impending trouble should be the signal for locating and remedying that trouble as soon as possible, else conditions will soon go from bad to worse and finally result in the total disabling of the machine or necessitate an expensive repair job.

The complicated mechanical structure of the commutator also is a source of inherent weakness, which may develop and hinder it from performing its electrical function in the required manner, with the result that extra duty may be imposed on some parts from others, heating occurs and both commutator and brushes suffer to the deterioration of the machine.

Thus no commutating machine is operating satisfactorily when the following conditions are apparent: (a) sparking at the commutator, (b) noisy operation.

As there are various causes which may be responsible or contribute to the above undesirable conditions, it is hoped that the following arrangement of cause, effect and remedy, may be of assistance to the operator in securing the best possible performance.

In locating the cause of any trouble, mechanical inspection should at first be resorted to and if this fails to reveal the defect, it may be inferred it depends on some faulty electrical condition. Therefore, in enumerating the various causes they are classified from their mechanical and electrical standpoints and we will first consider those pertaining to sparking.

Mechanical Points

(1) Displaced Commutator Bars: Large commutators with their great number of relatively thin segments and subject to high centrifugal forces, are very apt to undergo some displacement of the bars and a gradual readjustment during their first stages of operation. Symptom: The brushes may be broken or split, and will likely chatter and be abnormally hot. Remedy: Until a permanent condition is reached the commutator should be tightened, if loose, and trued up from time to time. To do this with small machines, the armature is taken out and turned off in a lathe. With large machines or those of the engine type, mounted on engine shafts, the commutator is either turned off with a lathe tool, or trued off with a grinding tool, with the armature in place in the machine. In the first case a device with a movable tool post is clamped to a stationary part of the machine, the commutator is revolved at the proper cutting speed, and light cuts made across the work. In the second case the commutator revolves at normal speed, while the rotating grinding wheel is moved across the face of the commutator. This form of device is shown in Fig. 1.

(2) Eccentric Condition: The commutator may run out of true due to a bent shaft, spring in shaft from engine thrust or looseness in the bearing. It may also become distorted by being overheated. Symptom: Careful examination shows a rise and fall of the brushes when the commutator turns slowly. The brushes will chatter when running fast. Remedy: If the eccentricity cannot be overcome by remedying these defects turning off or grinding at normal speed should be resorted to.

(3) Mechanical Vibration. This may be evident in machines operated at high speed as turbine driven units, motor generator sets. It denotes either unbalanced rotor or loose commutator, a bad belt, or unsteady foundations. Symptom: Considerable vibration is felt when the hand is placed upon the machine and sparking decreases if the vibration is reduced. Remedy: The machine must be re-balanced, either by balancing weights or pouring melted lead into pockets usually provided for that purpose. If a loose commutator is the cause, tighten up the bolts in the clamping rings.

(4) High Mica: This condition most frequently appears in large commutators having a relatively large number of thin commutator bars, where the percentage of mica is high relative to the copper. It shows that the copper is wearing faster than the mica. The use of soft carbon brushes, which though excellent for commutation purposes, are deficient in abrasive material, is usually responsible for high mica. Symptom: The projecting mica, be it ever so slight, can be detected by mechanical inspection. While running, fine pin sparks occur between the faces of the brushes and the commutator, which becomes blackened and burned. Remedy: Special machines are made for the purpose of undercutting the mica to a depth not exceeding 1-16 in. The slot should not be less than 1-32 in. wide so as not to harbor dirt. As a rule the centrifugal forces at this point are sufficient to throw out any ordinary accumulations of dirt.

(5) Dirty Commutator: One objection to undercutting is that material may accumulate in the slots, which with carbon and copper dust will form a conductor between adjacent bars. Dirt and oily dust is also likely to accumulate at the inner and outer corners where the brushes do not touch. Symptom: Such a condition is often the cause for sparking at the end of the commutator flashing and arcing over. Remedy: Make slot inspection and cleaning a part of the regular care of the machine. The end of the commutator should be thoroughly cleaned, and then painted with good insulating varnish, and repainted as often as necessary. The outer and inner corners should be slightly rounded as shown in Fig. II (about 1-16 in. radius).

(6) Pitting of Mica: It is generally considered that the pitting, or eating out, of the mica between the commutator bars, starts from some form of dirt getting in or onto the mica segments. This dirt is more or less of a conductor and the current carried by it, due to the voltage between bars, may sooner or later carbonize the mica so it in turn becomes a conductor. This carbonizing process goes on until holes of considerable size are sometimes produced in the mica. Oil is a common vehicle for transmitting or holding the dirt and care should be taken to see that no oil gets to the commutator by spraying, creepage, etc. Symptom: Burnt spots appear in the mica. Arcing occurs between bars when the current is put on. Remedy: Pick out all the burned particles and then fill the holes up with some form of high grade cement. That used by dentists is very good. Plaster of Paris with sufficient shellac for a bond may also be used. The filling material should be allowed to set thoroughly before the machine is used.

Electrical Points

(1). Wrong Brush Position:—The brushes may not have the proper lead, forward or backward from the neutral position to ensure sparkless commutation. Or the arms carrying the brushes may not be uniformly spaced around the commutator as a result of which some brushes may have the right lead and some the wrong lead. This does not apply to machines with commutating poles. Sympton:—Bad sparking as the commutator leaves the brush. Remedy:—Shift the brushes or replace the brush arms properly.

(2). Excessive Current.—Sometimes a sudden and very heavy overload such as a short circuit on the line, will cause the current to "bite" into the copper at certain points and leave a condition of roughness. Again a flash over will leave a flat spot on the commutator which will need to be taken out to prevent burning.

Symptom:—Roughness first appears on a few bars at intervals around the commutator. The condition unless removed tends to get worse and spread around the commutator because it sets up destructive sparking. Remedy:—Smooth the commutator with a fine file or fine sandpaper which should be applied on a block of wood that exactly fits the curvature of the commutator. Be careful to remove any grit particles that remain and never use emery. A block of sandstone used for the purpose is better than sandpaper because of its unyielding nature it shears off the mica at the same rate as it does the copper and leaves the commutator perfectly smooth. The sandpaper or sandstone block is applied while the machine is turning over but without load or voltage. During the smoothing process the brushes should be lifted off the commutator to prevent them from accumulating copper dust.

(3). Brush Conditions.—Anything

that causes poor brush contact at one part of the commutator throws an excess current to the other brushes of the same polarity, thereby causing them to be overloaded. Symptom: An overloaded brush may be detected by sparking, by glowing in which spots are heated to incandescence, or by honeycombing in which spots on the face of the brush appear to be eaten out, or by picking up copper where the copper appears to be deposited electrolytically in spots on the face of the brush. Honeycombing often starts at these spots of copper due to the localizing of the current. Remedy: Correct any roughness or eccentricity of the commutator. See that no brushes are clogged in their holders and that they bear with equal pressure on the commutator. The amount of tension to apply must suit the circumstances. Notice whether the commutator is worn in edges causing the brushes to ride up and down as the armature shaft moves back and forth in its bearing. This can be prevented by "staggering" the brushes so that the bearing surfaces in the different sets will overlap. Repair any bad contacts in the shunt connections between the brush and holder. A change in the grade of brush will sometimes improve operation where other things fail.

(4). Armature Condition.—An open circuit in the rotor winding, a bad joint in the winding or a short circuit will cause burning which will start at the bars connected to the defective coils. Symptom: The open circuit will make itself evident by sparking at the brushes. With a bad joint, the sparking may not be so much in evidence, but a gradual blackening of the bars will take place. The short circuited coil will roast out and be liable to damage adjacent coils. Remedy: Repair as soon as possible. In the case of the short circuited coil an emergency repair may be made cutting one of the commutator leads to this coil and attaching a jumper across commutator bars to which coil is attached.

(5) Field Conditions: Any conditions which may tend to weaken the field such as high speed or low operating voltage will result in the shifting of the point of commutation with change of load. Symptom: Intermittent sparking with change of load. Remedy: The trouble may be stopped by decreasing the load, shifting the brushes as the load varies, reducing speed or raising voltage.

(b) Noisy Operation

This condition indicates a faulty contact between the brushes and commutator through one or any of the following causes: (1) Dry Surface: A dry contact surface will usually cause "squealing" or "chattering" of the brushes. Remedy: It is stopped by using a different grade of brush with better lubricating qualities or simpler still, an occasional application of a small amount of clean oil, except in cases where the mica is undercut when it is not advisable to use oil. Never apply the oil with a cloth or any material having a loose fibre that will cling to the surface and get under the brushes. For this reason cotton waste is a poor material to use. Heavy canvas or a short length of tightly woven cotton hose is good.

(2) Angle of Brushes: The tendency in brushes to chatter may sometimes require the changing the angle of the brush or the relation of the angle to the direction of rotation.

(3) Brushes Loose in Holders: In brush holders of the box type a loose fit may allow the brush to vibrate or chatter. An easy sliding fit is best.

(4) Unevenness of Commutator or Brush Surfaces: Noisy operation is sometimes occasioned by some unevenness of the commutator which strikes the brush a small hammer blow at every revolution. In high speed machines this may split and break the brush.

The face of the brush should have the same curvature as the commutator and be ground to a good fit. Carbon brushes can be fitted perfectly by drawing a strip of sandpaper back and forth between them and the commutator while they are pressing down.

A commutator in normal operation soon acquires a rich bronze glaze or polish and constant vigilance is necessary to maintain it in this state so greatly to be desired.

NEW ALLIED TONNAGE

FIGURES of the new tonnage built during the six months from October, 1916, to April, 1917, have been published by the Bureau Veritas. No distinction is made in the figures between steamers and sailing vessels, but the number of the latter cannot be large:

	No. of ships.	Gross tonnage.
Great Britain	261	680,946
United States	150	484,381
Holland	103	190,619
Japan	46	128,913
France	42	61,988
Italy	20	34,051
Norway	42	34,044
Denmark	20	26,348
Sweden	26	20,023
Spain	7	4,422
Chili	3	823
Portugal	3	216
Russia	5	750
Total	728	1,667,524

THE ENEMY OF THE SUBMARINE

By C. T.

THE submarine has a deadly enemy—the aeroplane. For every poison there seems to be an antidote and this is a law of nature. The aeroplane can carry bombs capable of being set to explode either on contact with the water, or so many feet under the water. The submarine under the water is unable to see the aeroplane circling above, but the latter can and does see the shadow of the submarine many feet below the surface. Directly she goes down so does the aeroplane swoop and drop bombs upon bombs on the U-boat, which must either dive lower and lower, or come up and fight with anti-aircraft guns, if she possesses them. Actually the submarine has no chance against properly armed aeroplanes, especially if there are a number of them flying in squadrons. The obstacle to the successful operation of the aeroplane defence against submarines is that they are of limited carrying capacity and therefore only capable of effective work within a radius of 200 miles or so, even if of the most powerful type.

PATTERN FOR LARGE MAIN CIRCULATING INLET VALVE

By James Edgar

IN view of the fact that shipbuilding and marine engineering have recently come to the front as important Canadian industries, the article which follows, taken from the columns of our contemporary, the *Foundry Trade Journal*, will doubtless have more or less interest for those of our readers who are directly or indirectly concerned with the production of patterns and casting for marine engines and their accessory equipment.

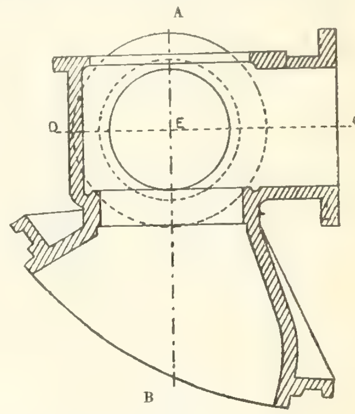
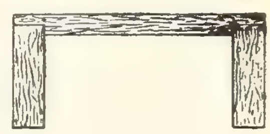
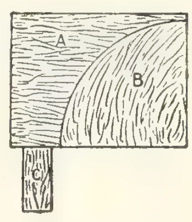


FIG. 1.

The first thing to be decided when

FIG. 2.





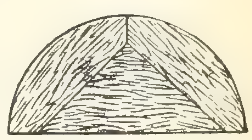


FIG. 3. FIG. 4.

making a circulating inlet valve of the type shown in Fig. 1 is whether the square chest shall be made in the form of a shell pattern, leaving the moulder to cut a print in the sand and use the inside as a corebox, or whether a block pattern shall be used with a corebox. Both methods of construction have advantages. The shell pattern is certainly more economical, as it takes much less timber, and the expense of making a corebox is saved. It is also much lighter, and this is a very distinct advantage if

the pattern has to be tried to place in the ship.

On the other hand, a blocked-up pattern will stand much longer, and prove

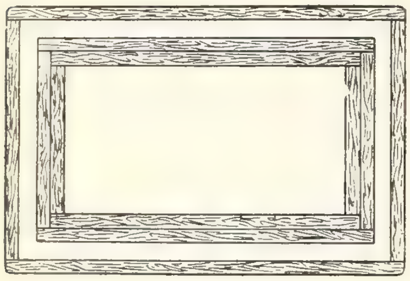


FIG. 5.

cheaper in the end, if many castings are wanted. However, it is very seldom that more than two or four castings of such a chest are wanted. It is usually necessary to "hand" this job, as there are almost certain to be cross angles on the flange of the square chest. This flange fits against the shell of the ship, and the position is usually marked on the drawing, the numbered frames being given. Occasionally approximate distances are given on the drawing, and after the pattern is made, it is checked at the ship, but more often moulds or templets are supplied by the mould lift from which the pattern is made, and sent off to the foundry. If the pattern-maker has to try it to place, a distance will be given from the line A B to a datum line, and, of course, the top flange must be level.

Two half-lapped frames should be first got out to make the joint of the pattern. They are dowelled together, and should be made of 1¼ in. or 1½ in. stock. It will be noticed in Fig. 6 that the frames include the branch C. It makes a much stronger job to bring the frames to the face of the flange than to fit the branches quite separately. It is also well to make the main body D with grounds and staves carrying it out to the face of the cover flange. The cover flange, not being thick, can be screwed on top. A really strong job can be made of the staved-up body by fitting three stays about 3 in. broad by 1½ in. thick, and letting them into the grounds as shown in Fig. 2.

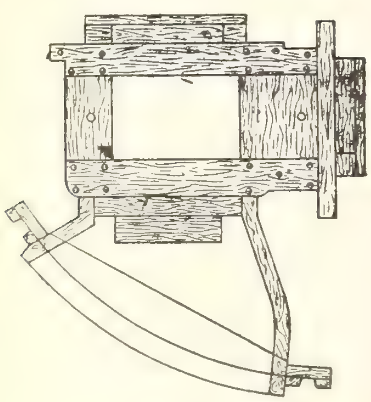


FIG. 6.

When the body has been fixed in position, the branch can be got out. It should be blocked up solid, and if a templet is stitched to it and a block screwed on the face to keep it square on the table, it can be cut at the bandsaw. The arrangement is illustrated in plan in Fig. 3, A being the templet, B the branch, and C the squaring block. The flange can be screwed on to the face. The prints for the branch C, Fig. 1, which would be 16 for the end of the chest, which will be still larger, had better be made with a 1 in. plate thicknessed with 2 in. timber on the back, as seen in Fig. 4. The top branch E, Fig. 1, unless it is very shallow, will be better built with segments. If it is very deep it can be staved, but staves have the disadvantage that they cannot be fitted and screwed as well as segments. The flange for this top branch must, of course, be dowelled on.

The square chest ought to be made and finished quite separately from the valve body and screwed on afterwards. It should be made to a line sufficiently far back from the face to clear the angles, the handling being done by alteration strips. Two plates have to be made for the top and bottom, and they can be temporarily battened together. Two ends can likewise be got out. The side pieces

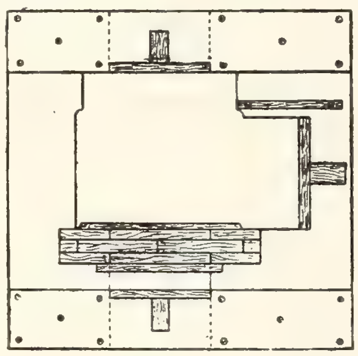


FIG. 7.

must be very carefully drawn off and dowelled together on edge. To build this chest one of the end squares should be first screwed to the bottom plate and two sides screwed on. The top end piece can now be laid on top of the other, the two temporary battens screwed on the outside. The dowelled sides can now be put in position, and temporary battens likewise screwed on to them. The top plate can next be put on.

The method of building one half on top of the other has obvious advantages. If care has been exercised in squaring and dowelling the sides, the top should lift "sweetly" from the bottom and without any drag. When the corners of the chest have been rounded off, the battens can be removed, and each half screwed to the valve body. A print will have to be screwed inside this chest to carry the body core. It will be observed that the print is smaller than the core for the valve seat, to allow sand around it.

The flange and the fitting strips on the face can now be attended to. Pieces ought to be screwed on, carrying the body to the face of the flange. It is usually possible to change the chest from port to starboard, by bringing the top piece to the bottom and the bottom piece to the top. The side pieces can also be turned upside down. The flange will have to be screwed on, taking care that the flange on the moulder's bottom half is screwed from the inside of the chest and on the top half from the outside. It is not necessary to explain the making of the fitting strips and spigot, which are screwed on the face. The moulder, of course, will have to loosen off these strips and

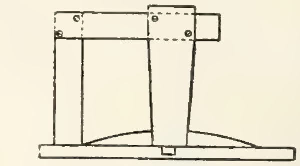


FIG. 8.

also the supporting ribs on the sides. A view of the face is shown in Fig. 5. The joint of the finished pattern is shown in Fig. 6.

In a valve as large as this, a plate or an open frame would be quite satisfactory for the body core. Some foundries prefer a plate, others prefer a frame. From the pattern-maker's point of view the work is the same, except that if a plate is made the end grounds for strickling the core will be a half diameter, whereas if a frame is used they will be a half diameter less the thickness of

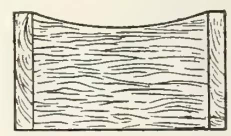


FIG. 9.

the frame. A plan of the frame with the grounds on is shown in Fig. 7.

A bridge piece should be made to carry the valve seat. It can be built in two or three thicknesses, and should be about 3 in. broad. A runner is screwed on each face of this ring, and the strickles will work on this runner with a semi-circular strickle, guided by a strip on the frame.

There is still a top branch core to be made. It is 16 ins. in diameter, and might be made with a pin board, as shown in Fig. 8. It may be that the moulder

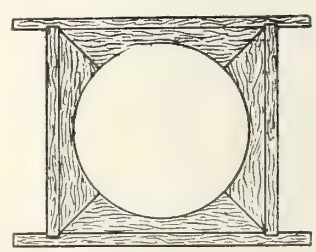


FIG. 10.

will prefer a box, and one can be made almost as cheaply as the pin board. An end view of a suitable box is shown in Fig. 9 and a plan in Fig. 10. It is simply a square frame with mitred skeleton pieces nailed inside. A skeleton box made in halves would be almost as expensive as a solid box, and this style is as convenient for the moulder, as it can be taken apart like any ordinary frame corebox.

Brief Historical Sketch of Steam Boilermaking in Canada

By D. M. Medcalf *

The development taking place in our shipbuilding industry, more particularly that of steel construction, and the intimate relationship that exists between it and steam boiler building, make a retrospect of the associated crafts' achievement in Canada peculiarly opportune and interesting meantime. The article embodies the substance of an address delivered before the American Boilermakers' Association at their recent Annual Convention.

WHEN choosing this subject, I hoped to be able to obtain some assistance from the compilations of historians who have linked together the memories of past and present industries in Canada, but have been disappointed because they have overlooked the existence of the black squad who toiled in an unpretentious way, building steam boilers for our early industries. These horny-handed sons of toil appear to have passed away unhonoured and unsung, and their memories have been almost forgotten, save by a few of our old boilermakers and engineers. I have, therefore, decided that, rather than go into the details of construction in this paper, to treat the subject more in a general way.

Doubtless, the first boilermakers in Canada were located around the eastern seaboard. In the early part of the eighteenth century, settlements clung close to river, lake and sea, and the St. Lawrence, the St. John, and their tributaries, besides other lesser rivers, provided inevitably the points of settlement and the lines of travel. The development of water transport in Canada is interesting and furnishes a record of need, invention and enterprise, and not the least among these was the advent of commercially successful steam navigation.

Advent of Steam Navigation

First came the bark canoe, large enough to hold a few voyagers and peltry, and for a long time it held its place for the far journeys. For shorter travels, the canoe was superseded by the larger, but clumsier, bateau. In later years, the increase in river freight led to the introduction of the still larger Durham boats, whilst along the coast and on the great lakes the sailing schooner long filled a notable place. Finally the steamboat came in 1839. Only one year after the Clermont had begun its regular trips on the Hudson, there was built at Montreal the forty-ton steamer Accommodation, and seven years later the Frontenac, of about seven hundred and forty tons displacement, was launched.

It is noteworthy that the first steamship to cross the Atlantic without auxiliary aid was built in Montreal. This vessel was called the Royal William, and left Canada on the 5th August, 1833, for London, and arrived there about one month later. Our early Canadian boilermakers were, therefore, amongst those pioneers who not only developed water transport in Canada, but inaugurated ocean steam navigation. Marine boilers at that period were built rectangular in form of the marine flue type, carrying from 10 to 20 lbs. pressure. Boilers of this type, with certain modifications in design, were in vogue for a considerable time, and gradually developed into the Scotch marine type, with which we are all familiar. The development of these boilers was, of course, due to the efforts of Scotch engineers on the Clyde.

Boiler Types

With regard to the manufacture of boilers in Canada, around 1850, there were quite a few of the old pioneers engaged in this work. A list of names would perhaps be of little interest now,

D. M. MEDCALF.

but I mention the following firms who are still extant:—

E. Leonard & Sons, London, Ont., established 1839.

Waterous Engine Works Co., Brantford, Ont., established 1840.

John Inglis Co., Toronto, Ont., established 1859.

John McDougall, Caledonian Iron Works, Montreal, established 1858.

Goldie & McCulloch Co., Galt, Ont., established 1844.

Besides these, there was a large number of thriving little boiler businesses, long since petered out, like the Dicky Neal and John Perkins boiler works of Toronto, Joseph Hall, Oshawa, etc.

Pioneers in the Craft

In those early days, that is, sixty or seventy years ago, the types of boilers generally in use were externally fired with three to five flues, 8 to 10-in. diameter. There has been little development in this type of boiler, and the H. R. T. in use to-day is typical of the boiler used then. The diameter of these boilers seldom exceeded 54 inches, but what they lacked in girth, they made up in length, as twenty to twenty-five feet was no uncommon stretch for those old stagers. The seams were all of single-riveted, lap construction, and the plates ranged in thickness from ¼ in. to ⅜ in. The shell rings and also the tube rings were telescoped one into the other, like stove piping. They were very strong on domes at that time, and I believe a boilermaker then did not think he was building a boiler at all, unless he had a huge dome on the outfit. Most of these early domes were cast iron, and some of our manufacturers adhered to this style of dome until as late as 1890, in which connection I venture to say a good many explosions have resulted from these castings fracturing, two accidents of recent date coming under my own personal notice.

Materials of Construction

With the exception of the domes of some of these boilers, wrought iron was the material almost exclusively used in their construction. The brands of iron were Lowmoor, Yorkshire, Bowling, Thornycroft, etc., all imported from the British Isles. As a rule, the plates were short and measured about 4 ft. 6 in. square. These sheets were soft and ductile, but blisters or laminations were not infrequently met with, which caused considerable loss and inconvenience. Another imperfection was that of spongey parts, generally due to imperfect puddling, but, notwithstanding these defects, the old iron boilers gave good service, and we have many still in service, after thirty or forty years of general wear and tear. The majority of the boilers then were used in saw mills and flour mills, and were often employed to augment the power of a water wheel. The steam pressures carried were low, and forty to fifty pounds was looked upon as a very high pressure indeed. Fuel was cheap, as wood was plentiful, but coal was very scarce and seldom used, except by the blacksmith in the smithy fire, and the moulder in his cupola.

Our plate rolls were originally made of wood and were operated by hand. This, of course, was only made possible by the size and thickness of the sheets

*Chief Inspector of Steam Boilers, Province of Ontario.

used at that time. Punching was done by hand with a screw or bear punch, and sometimes as many as four men were employed at a time to pull on the punch lever. All holes were punched full size, and those that did not come fair enough were usually persuaded into alignment by the gentle assistance of drifts and sledges. Sometimes a taper reamer was used, but this was the exception, rather than the rule, and any holes which could not be reached with the punch were cut with a round-nosed chisel. The head plates were flanged with large wooden mauls over cast iron flange blocks of the required size. It was customary to make the heads a little undersize, so that they could be drawn out gradually to the exact diameter.

Heads were dished in a very crude manner by digging a hole in the ground, somewhat resembling the desired curvature of the head. The circular plate was then heated and beaten down into this hole with wooden mallets, the finishing process being accomplished by flatteners and sledge hammers. It sometimes happened in the case of heads dished to a deep camber that the work could not be done in this way, and a large cast-iron ball was often used to advantage. This ball was hoisted a certain distance, then dropped on the red-hot plate in much the same way as a pile driver.

These—what now appear to us—crude methods of the early boilermakers have undergone a vast change in the last fifty years. The up-to-date machinery now in use for every branch of this industry has almost entirely superseded hand work, and there is just reason to be proud of the modern steam boiler which our manufacturers are turning out today in large quantities. We must not, however, despise the useful work of our predecessors, for they built many good boilers in those good old days.

Boiler Inspection Feature

We have a large number of boilers in Ontario that were constructed before the present Act governing the construction of boilers came into force and took effect, which were built in a thorough workmanlike manner. We also have some that are not so good, and they were not all built in Canada, but since the enactment of the present law, we are quite satisfied that better boilers are now being turned out, and the purchaser is safeguarded as far as workmanship and material is concerned.

No matter how rigid the inspection, it is not a guarantee that the boiler will not explode, because it largely depends upon the care and attention the unit receives when in operation, how long it will remain in useful service. Quite recently, I was requested to make a personal examination of two 66 in. x 16 ft. H. R. T. boilers that had been seriously damaged. The boilers referred to were built from an approved design and inspected during construction; the shell plates were fabricated by one of the largest plate manufacturers in the United States, and were carefully examined before any work had commenced, the heat numbers and tensile strength recorded and passed as being suitable for a steam boiler. The workmanship was also examined during the entire construction, and upon completion, the boiler was passed, and certificates issued in the regular way. After these boilers had been in service six months, they each developed bags on the sheets directly over the fire, extending four inches down, three feet wide and five feet long, and on account of their being practically new, the owner claimed that the cause was poor material and workmanship, and I personally acted as a referee in the settlement.

When I visited the plant, and when trying to squeeze into the regulation inspector's outfit—which is now too small for me—I requested the owners to have the manhead under the tubes removed. The manhole in top of shell was open and ready for the inspector. Immediately the light was flashed on, the interior of the boiler, it was quite apparent what caused the trouble. The water that lay in the depression was covered with black spots, and the tubes and shell, as far as could be seen, were coated with oil.

It was at first a difficult matter to convince the owners that oil had caused the trouble; it was a new plant, and oil they claimed could not get into the boiler because they had installed an expensive oil separator in the exhaust line from the feed pump, which was the only steam line returning its condensation to the boilers. A further examination was made by disconnecting the oil separator, which was found quite clean, but beyond the outlet a full handful of grease was collected and shown to them, with the result that they were quite satisfied that they themselves were to blame, and not the poor manufacturer, who made the boilers to comply fully with the requirements of the Province of Ontario. The necessary repairs cost about $2,500 and considerable inconvenience to the operation of the plant.

I could cite a number of cases very similar to this one, but believe there is "nuf sed," and my object in mentioning this fact is because frequently when trouble develops, and the cause of same is not known, it is blamed on the rotten old boiler made by so and so, who is really blameless.

War Effect on Canadian Boiler Making.

Now, in regard to the effect of the war on the boiler-making industry in Canada, I might say that its penetrating influence has affected almost every industry we possess, either directly or indirectly, and the most seriously swayed of these have been engineering and allied trades. Almost since the beginning of the war, or, to be correct, since the Governments of the Allies began to place orders abroad for the supply of munitions, most of our boiler shops have been partly converted into munitions factories, whilst our machine shops are similarly engaged, running night and day.

Besides making shells, however, our boiler shops are turning out boilers in fairly large numbers, not only for domestic use, but for export trade, chiefly to the Allies, and we have orders for many more which cannot be supplied by reason of our inability to obtain the necessary material. It is true, therefore, that the war has increased the output of our boiler works, and it is also true that the war is retarding that output, owing to the scarcity of steel, or, to be correct, owing to this merchandise finding a more ready outlet in another channel; a large number of the mills, I believe, who are working on metals have sold their full production one year in advance for war purposes.

Dearth and Cost of Steel

The dearth of steel, however, is not the only obstacle. The price of steel, as you all know, has been going up with leaps and bounds since the war began. Labour conditions are also very bad, and good boiler makers to-day cannot be had in anything like sufficient numbers to cope with the increase in business. From the beginning of 1915 to the present time, but more especially in 1915 and 1916, a large number of munition factories and like industries, which were urgently required to meet the existing crisis suddenly sprung into being, and consequently more boilers were required. Our manufacturers having only their usual stock of plates and tubes on hand were very soon unable to supply the goods until more material was forthcoming, and this occasioned much delay. Those factories, therefore, which urgently required boilers turned their attention to the second-hand market, and used boilers were largely sought after. Old boilers of all descriptions were painted up and offered for sale as good boilers, and, needless to say, many were condemned by our department. These scrap boilers have in turn found their way to the furnaces to be melted into shell billets, and latterly shipped to Germany via France. Perhaps a part of one of our old boilers, after undergoing this transformation, may yet find a resting place in the Kaiser or the Crown Prince.

The demand of late has not been so much for stationary boilers, as for marine boilers, and our manufacturers are harder pressed now than ever for steel plates and tubes, and, although they are turning out a lot of work, the demand by far exceeds the supply. If we only had steel plate mills of our own in Ontario, it would have been of great assistance at this period, but unfortunately we are not sufficiently advanced along those lines, and have to depend entirely on imported material.

Instead of Babbit Metals.—As a substitute for babbit metals an inventor proposes to use mixtures of metallic sulphides in widely varying proportions. He considers that the sulphides of copper, lead, tin and antimony make good babbitt substitutes. Metallic sodium is used to improve their casting properties.

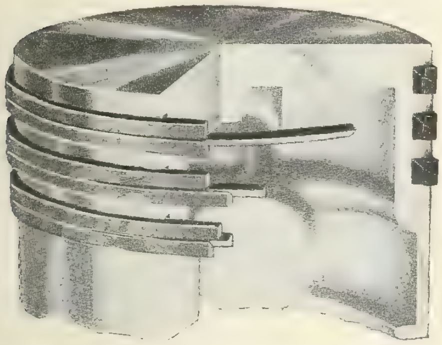
It is not commercially possible to burn more than 99 per cent. of bituminous coal fed to the furnace.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

IMPROVED TYPE OF PISTON RING

CYLINDER efficiency is an essential in the successful operation of any type of pump or engine, be it air, gas, steam or hydraulic. The one outstanding feature in engine construction that has received more thought and attention than any other is the piston. The effective power of an engine is largely dependent upon the free running movement of the piston and the total absence of leakage, either when driving or under compression. This effect is only assured when the piston rings have been accurately fitted in their respective grooves, and even then the durability is more or less uncertain, owing to the variable conditions.



DOUBLE TYPE OF PISTON RING WITH BEVELLED SPRING SUPPORTING RING.

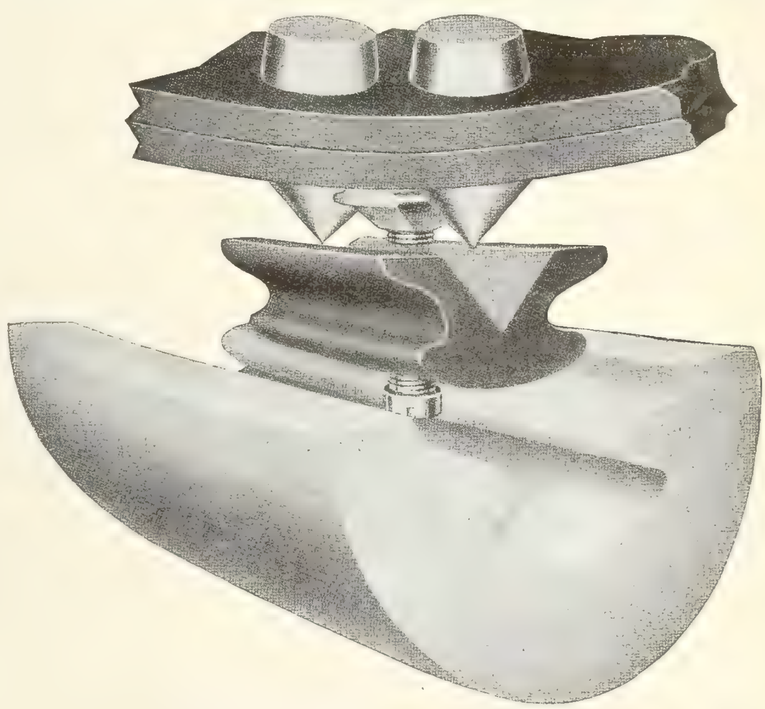
In the accompanying illustration is shown an interesting and highly serviceable type of piston ring, designed by E. Duchesne, Montreal, and being made in various sizes to suit any make of cylinder, from motorcycles and automobiles to locomotives and marine engines. In the design of these rings, several features have been incorporated to increase and maintain the efficiency of the engine, and also extend the useful life of the rings themselves. In the ordinary one piece split ring, the pressure against the cylinder wall is obtained by the spring in the ring itself. The special rings here described not only contain their own initial spring, but are prevented from any possibility of "setting" by the action of the inside wedge ring, which is made from special spring steel. The construction prevents this interior ring from coming in contact with any of the friction surfaces; its essential purpose is to maintain a constant but flexible pressure of the cast iron rings against the cylinder bore. In addition to the radial thrust, the 60 deg. bevel of the spring ring acting against a similar bevel on the inner middle edges of the friction rings assures a perfect fit on the sides of the groove, resulting in a permanent fit irrespective of any subsequent wear.

With a one-piece ring the lateral fit is often so good that any slight binding of the sides prevents the free radial movement of the ring, when the same is passing over imperceptible irregularities of the cylinder bore; or, after becoming worn, will allow the steam or gas to "wire draw" down the sides and below the rings. The three-piece rings here shown have the distinct advantage that they will adjust themselves to the above conditions and entirely eliminate binding or wire drawing. It may be also stated that the possibility of the gas or steam leaking down the sides and below the rings is reduced to the minimum in this type of ring, as the action of the inner spring forces the two outer portions firmly against either side of the groove, thus avoiding any space where the gases could enter and thereby increasing the engine efficiency. Another highly interesting feature in the manufacture of these "Wedgerite" piston rings is the softer grade of cast iron than is generally used for the purpose. Where it is necessary, as in the one-piece ring, to rely upon the spring of the friction ring to maintain contact on the cylinder walls, it was the practice to use a hard iron to insure a durable spring, but the adoption of the spring steel ring permits a softer iron in these special piston rings, which minimizes the wear upon the bore of the cylinder. These rings are cast independently and ground to the desired dimensions and eccentricity. Vincent & Morris, Montreal, are placing this article on the market.

BOILER GIRTH SEAM PROTECTORS

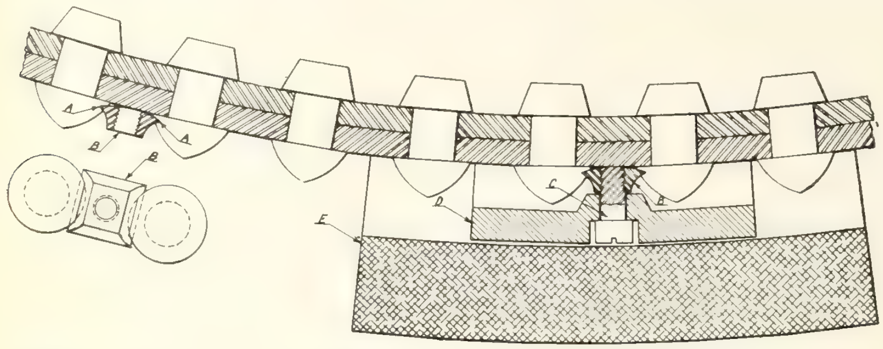
A TROUBLE always present in horizontal tubular boilers is that arising from cracks on the boiler shell surface, directly above the fire chamber. These defects invariably originate at the girth seam, which, owing to the general construction of this type of boiler, is located immediately above the fire, where it is exposed to intense heat. The heat in itself is not the objectionable feature, but owing to the necessity of opening the fire box door to replenish the fire, this portion is subjected to continually varying stresses, caused by the frequent expansion and contraction of the plates. In an effort to minimize this trouble boilers have been designed where the section exposed to the high temperature of the fires, has been made in one piece, to bring the seam in a position out of the direct action of the hot gases. Owing, however, to the great area required, this method has not given satisfaction, and the seam has still remained more or less a source of trouble and inconvenience.

A simple device for preventing the formation of fire cracks that has been recently perfected, and for which patents have been granted, has been placed on the market, and installed on a large number of boilers, both in the United States and Canada with remarkable results. It is claimed that a boiler equipped with this seam protector will be permanently protected from all danger of fire cracking and subsequent leakage resulting



SEGMENT OF BOILER GIRTH SEAM PROTECTOR.

therefrom; an unprotected seam that has developed a leak can be caulked tight and fitted with this device, and the claim is made that the seam will remain dry indefinitely. The illustrations herewith show a general view of the detached parts and the method of applying to the boiler shell. It will be seen that the application of this seam protector is very simple and that it does not interfere with the heating qualities or detract from the strength of the seam. As a matter of fact, the construction of the protector, with the large semi-circular sections of fire brick or reinforced asbestos, provides a reserve of heat that prevents any sudden reaction in the seam when the fire door is opened or closed. As the cold outside air from the open door or the hot gases from the fire are not permitted to come in direct contact with the boiler seam, the effect is to retain a uniform temperature on the outer lap, thus avoiding sudden or violent contraction or expansion of the lap.



SECTIONAL VIEW OF BOILER SEAM PROTECTOR SHOWING METHOD OF ATTACHING TO RIVET-HEADS.

In addition to preventing exterior fire cracks, it has been demonstrated that the accumulation of sediment along the edge of the inner lap, and about the heads of the rivets—a condition that is generally the cause of interior mud cracks—is largely, if not entirely eliminated, as the retaining of a more uniform temperature at this particular point has shown the tendency to prevent the formation of injurious muddy scale that bakes to this portion of the seam, when the same is exposed to the direct action of the fire. It is thereby claimed that these protectors have made the weakest portion of the boiler equally as strong and durable as any other part.

In fitting this boiler seam protector to units already in service, two adjacent rivets, at suitable distances apart, on the girth seam, are notched by means of a special diamond point chisel as shown at AA to receive the wedge nut B, this being made a snug fit. When same is in position, the metal lug or tile support D is attached by means of a small ½ in. bolt C. When this is firmly placed, the fire brick or asbestos tile E is slid over the extending lugs of the cast iron piece D. Each one of these units is placed approximately 9½ in. apart, and five or more may be required to cover the length of the affected seam. This seam protector is not only used on stationary boilers, but is applicable to all fire exposed seams on locomotive and marine boilers. These seam protectors are manufactured in Canada by the National Boiler Protector Co. of Canada, 382 St. James Street, Montreal.

FLEXIBLE TURBINE GEARING

By L. E.

THE problem of ensuring equal distribution of pressure over the whole surface of the wide fine-pitched gears now coming into use for marine turbine speed reduction is being tackled in many ways. H. A. Macalpine, who was the first to act upon the growing realization of the matter, has proceeded upon the line of supporting the pinion in a rocking or floating cradle designed to permit of a continuous self-adjustment of the pinion to the wheel. In one of his arrangements the frame supporting the pinion is constructed so that the solid metal will afford a certain amount of spring whereby when the tooth pressure becomes unduly heavy on one side of the gears, due to unavoidable imperfections in gear-cutting or disalignment of the two shafts, that side yields just enough to allow the pressure to spread equally over the whole face. In another arrangement the same effect is obtained by sustaining the pinion bearings on interconnected hydraulic pistons.

The Macalpine device has now had extensive trial both on large mercantile vessels and on several battleships, and, though there has been a good deal of controversy on the matter, may be said to have established its claim to show a marked though varying advantage over the usual type of gearing on the respective scores of efficiency, durability, smoothness, and silence of working, amount of lubrication required, degree of reduction possible and weight of gearing set.

Sir Charles Parsons, confronted with the same difficulty, believed the solution lay in eliminating as far as possible the inaccuracies which the teeth of all large gears revealed, and set to work to discover and eliminate their source, arriving eventually at the ingenious methods by which the errors in the master gear of the gear-cutting machine are distributed over the face of the cut gear. By this means a considerable improvement was effected in the working of reduction gears without interfering with the solidity of the pinion journal supports, but it is doubtful whether even absolute initial accuracy, could that be obtained, would in the long run give as good results as some system of automatic continuous self-adjustment; for initial gear-tooth errors are only one part of the derangements of alignments that have to be provided against—there are also the torque of the pinion, the gradual wear of the bearings, and the slight but material distortion of the gear from under varying loads.

A third way of approaching the problem has been undergoing development for some years past. It consists of building up the main gear with a series of discs, chambered at the sides, threaded upon second-motion shaft. When first put together these discs are in close contact both at the hubs and at the rims, and the built-up gear blank is turned end out just as though it was a solid gear, but when the cutting is finished a parting tool is run down between each pair of discs, so that the gear in its final working form appears as a row of discs secured rigidly to the shaft and to each other at their bosses, but separate at their peripheries. The teeth are, of course, cut helically, and the effect of the disc construction is that when in working undue pressure comes upon any disc at any point of its circumference the disc deflects sideways, and thereby allows the load to spread over the remainder of the discs.

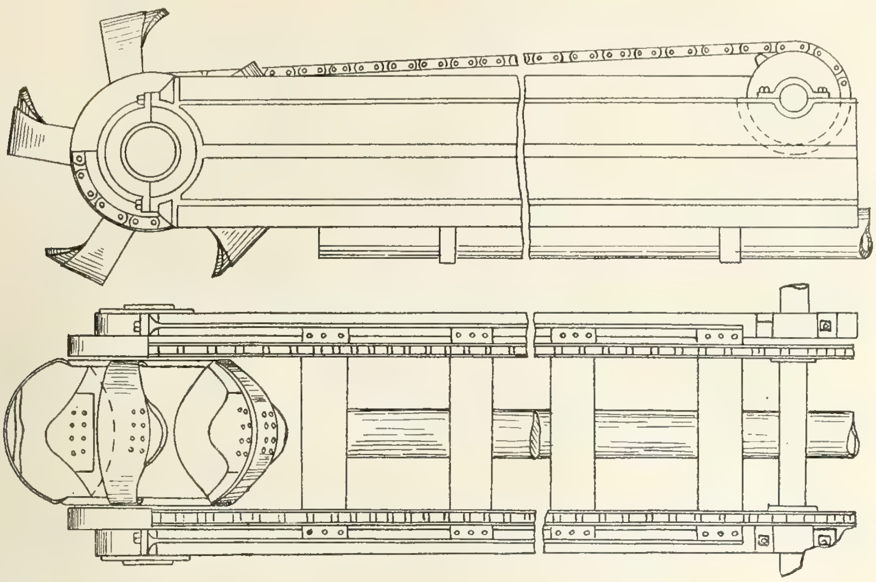
The proportioning of the discs, particularly as regards strength and contour of cross-section, is obviously a matter calling for careful calculation and experiment in order that the lateral deflection may at no time involve fibre strains which could possibly cause destructive fatigue, but a very small side movement is sufficient to afford even distribution of load across the entire surface of the gear. This type of flexible disc has now been applied to some eighty sets of turbo-generators with uniform success and is at present undergoing trial as a turbine reduction gear for steamships.

MECHANICAL CUTTER FOR SUCTION DREDGES

THE accompanying illustration shows a novel type of cutter for use with clay-cutting suction reclamation dredges. It is the invention of James F. Brown, a Canadian engineer, and acts on the elevator bucket principle when used for moored dredging. It may also be used conveniently for the type of dredge known as the drag suction dredge, the combined feature being one of the novel points of the device.

The apparatus is of simple construction, consisting of a frame work carrying a vertically revolving bucket cutter at one end, driven by chain from a power shaft at the other end. The suction pipe is located in the lower part of the frame. The cutter may be operated at any desired depth, the material cut being delivered by the buckets onto the suction pipe. Should any extra hard ma-

terial be met with when the cutter is being used as a drag dredge, the cutter is set in motion and the material broken up by the revolving cutter after which it may remain stationery while drag

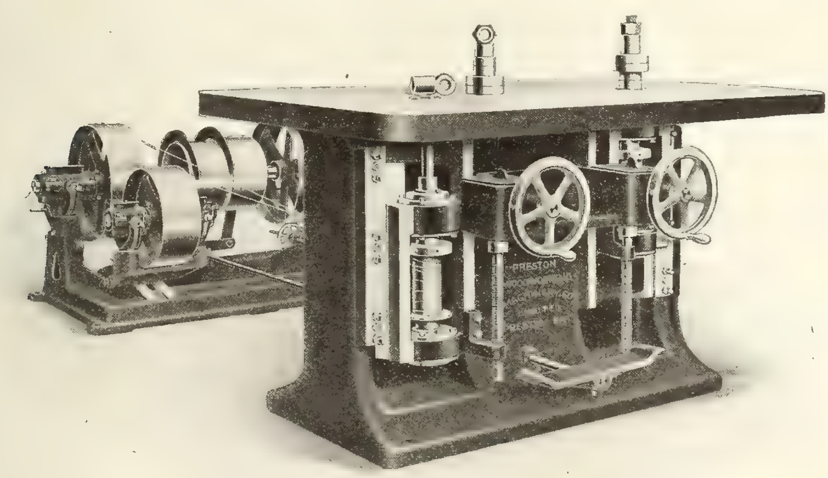


MECHANICAL CUTTER FOR SUCTION DREDGES.

dredging is resumed. Side thrust, as met with in ordinary horizontal rotary cutters is entirely obviated, the resultant thrust being directly in line with the ladder.

HIGH SPEED BALL BEARING SHAPER

THE shaper shown in the accompanying engraving is a recent product of the Preston Woodworking Machinery Co., Preston, Ont., and has been designed with a special view to increased output with less effort on the part of the operators.



HIGH-SPEED BALL-BEARING SHAPER.

The workmanship and material are of the usual high class necessary for the satisfactory operation of machines of this class, a feature of this machine being the use of SKF self-aligning ball bearings which enable a spindle speed of 7,000 rev. per min. to be maintained without any bearing trouble, and at the same time stand up under the increased output rendered possible thereby.

The spindle top diameter is 1¼ in., the table being 58 in. by 41 in., both table and main frame being of massive proportions and ample weight, which, combined with well balanced free running spindles, insures a high quality of work.

The machine, which weighs 2,700 lbs., has a front projection of 17 in., with a height of 35 in. The spindle diameter is 2 3/16 in., the spindles centres being spaced 28 in. apart. The power required is 3 horse-power, and the countershaft is completely equipped with tight and loose pulleys, idler pulleys and belt shipping gear.

"If you go first, dear, you'll wait for me on the other shore, won't you?" questioned the fond wife. "I suppose so, returned her husband, with a sigh. "I never went anywhere yet without having to wait for you."

Screenings

Rector (after exposition of Sunday school lesson to infant class)—"Now' would any little boy or girl like to ask me a question?" A Terrible Infant—"Have you got on trousers under that nightgown?"

"Women have very little sense of humour," said the cold-blooded citizen. "I don't know about that. Henrietta can see a joke as quickly as anybody. Every time the children talk about wanting to grow up to be smart and industrious like their father she laughs."

At a munitions-canteen a workman had called for a cup of coffee. Half a minute after receiving it he was back at the counter. "There's something funny about this coffee, miss," he said, "it tastes just like cocoa." The waitress sipped it and apologised. "I'm so sorry," she said, "I've given you tea."

Private Jimson was relating his experiences of the war. He said he was once taken prisoner and the enemy stripped him of all his clothing.

"Did you feel the cold much?" asked a friend.

"No," replied Jimson, "not at all. You see, they carefully covered me with their rifles."

Sandy and John were sitting in a 'bus, when a pretty girl got in and smiled at the former. He raised his hat.

"Do you know her?" asked the Englishman.

"Oh, yes, very well," the Scot replied.

"Well, shall we go and sit over beside her, and then you can introduce me?" asked his companion.

"Wait a bit," returned the canny Scot, "She hasn't paid her fare yet."

The minister of a rural parish being once sent for to a shepherd's house to "christen a wean," a big fat hen was killed for the christening tea. Like most herd's children, those in the house in question were allowed to run about half wild, and glowered with holy fear from behind doors and chests at the parson, who was observed to be eating most of the hen. The youngsters no doubt made many sage reflections on his voracious appetite, but took care to keep out of his reach. A month or two after, when the minister was visiting in the parish, he came back to the shepherd's cot, and as he seated himself in an arm-chair by the fire a number of chickens marched in, having the run of the house as usual. The children seemed terrified, but at length rushed in between the poultry and the minister, and cried, "Gae 'wa,' gae 'wa'!"

Then they "whusht" the chickens out of the house, exclaiming, "Whish, whish —run, run! That's the man that ett yer mither."

Special and General Applications of Autogenous Welding

Staff Article

It is now a generally recognized fact, that, given suitable apparatus and proper care in operation, there are few limits, except extreme volume of metal, to the successful commercial use of the oxy-acetylene welding process. Not alone in repairs, but in regular manufacturing operations the welding department is assured of permanent prominence.

OXY-ACETYLENE cutting and welding is rapidly being recognized as a very important and essential branch of modern engineering practice; not alone in effecting repairs, but also in connection with the initial production of many lines of manufactured articles. At the commencement of the present century the practical application of this art was almost, if not entirely, nil; its use being chiefly confined to experimental work in certain scientific laboratories. While in many respects the progress that has been accomplished in the autogenous method of welding has been very remarkable, it is doubtful if its practical growth has advanced in relative proportion to its usefulness and adaptability. One of the chief reasons for its comparatively slow development has been the skepticism of many mechanical men as to its serviceability under severe test. It is true that many of those who, in the past, have shown reluctance to accept the possibilities of this new method, may have been influenced by the unsatisfactory work of inexperienced operators, where the weld has been made without the necessary technical knowledge that is absolutely essential for the achievement of sound and reliable welding.

Faulty or defective welding can be traced more often to the inexperience of the operator, or the careless manipulation of the blow pipe, than to any other cause. It must not be thought, however, that faulty welding is always directly due to the inability of the operator in the actual making of the weld; for while the fusing and uniting of the metal is the essential factor in this class of work, there are other equally important features that require careful attention in order that the desired objective may be attained. The preparation of the work requires more than ordinary consideration, particularly where the prices are of such a character that the heating of the adjoining metal will create internal stresses and distortion; the result in such cases invariably being a recurrence of the break, either while cooling or after the piece has been placed in service. The second failure may occur at the weld, or if this has been well done, at the weakest point adjoining. Under the conditions just cited, where the uneven expansion and contraction is one of the problems to contend with, it is only by experience that operators are able to successfully overcome any difficulties that are likely to arise. It is unquestionably true that the application of heat will cause metal to expand; therefore it is this condition, and the calculations made by the welder for these contingencies, that assures the success or failure of the job. Where the expansion does not develop stresses in the work it is seldom that preheating is resorted to, but where the work consists of different shapes and thicknesses, such as pulleys, gears, small cylinders, etc., the practice of preheating the work is generally adopted. This process allows the entire piece, or that portion adjacent to the weld, to assume a condition of expansion that permits of uniform contraction of the metal after the weld has been completed, thus eliminating the strains that might otherwise develop.

FIG. 1. BEVEL GEAR 85 IN. DIA. REPAIRED AFTER BEING BROKEN IN NINE SEPARATE PIECES.

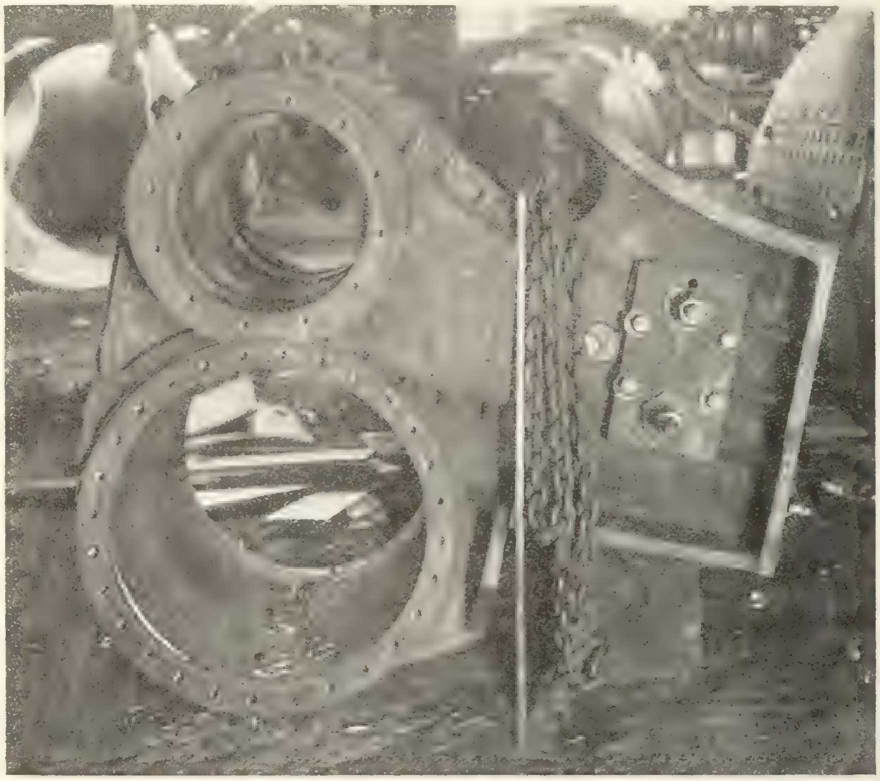


FIG. 2. LOCOMOTIVE CYLINDER CASTING WITH DEFECTIVE BORE REPAIRED BY AUTOGENOUS WELDING.

The best method of heating and the proper distribution of the heat can only be determined from previous experience, as the various jobs must be considered according to their own special requirements. Not only is it necessary to preheat certain work to avoid subsequent failure through unequal contraction, but it is very often also advisable from an economic standpoint, as the assimilation of heat in the material assists in the fusing of the metal immediately adjoining the crack being welded, and to a large degree prevents the possibility of cold shuts; this objectionable feature often occurring, particularly when the blow pipe is in the hands of an inexperienced operator. It is, however, interesting to note that the mechanical world at large is giving more favorable consideration to this branch of engineering than has ever been accorded it in the past, realizing that its field of usefulness is increasing very rapidly, and is becoming a contend-

ing factor in many ways. While the field of autogenous welding, as a manufacturing feature of the metal industry, is showing interesting developments, it is in the repairing of machinery and other mechanical equipment that its application has been most pronounced. Frequent opportunities have arisen during the past three years which have greatly emphasized the importance of this industry and the inestimable value that its general adoption would eventually be to many industrial activities. Conditions that have characterized the metal working trade during the period of war developments, where the outstanding feature has been the inability to obtain machinery or material—except on very extended delivery—have necessitated manufacturers adopting methods that would not have been considered in normal times. Delay of this nature has often resulted in the overhauling of the scrap pile in an effort to utilize discarded parts and assemble them in such a way as to become a very useful part of the plant equipment. In this connection it is safe to say that the oxy-acetylene process of welding has been an essential factor in converting scrap into useful machine tool attachments. Not only has this practice been the means of reducing the size of the scrap pile, but it has also been of material assistance in the saving and putting back into prompt service machinery that would otherwise have remained idle for long periods while broken parts were being replaced.

Repairs to Large Gear

To illustrate the importance that this method of reclamation bears to general industrial work, we give here a number of practical examples that have recently been successfully accomplished in the plant of the St. Lawrence Welding Company of Montreal. Fig. 1 illustrates a large cast iron gear, 85 in. dia., used on a heavy mixing machine. For some apparently unknown reason the machine became jammed, with the result that the gear was broken into nine parts, as indicated by the ten cracks marked by the arrows. The breakage of this gear not only meant the stopping of this particular machine, but left the greater portion of the plant in a state of practical shut-down while the machine was out of commission. To replace this gear with a new one meant a delay of many weeks, as few foundries were in a position to undertake the work. It was, therefore, decided to reclaim the gear by welding the broken sections. The "scrap" was taken to the welding plant and the broken parts prepared by roughly beveling the edges to an approximate angle of 45 degrees, thus making an included angle of about 90 degrees when the parts were placed together; the cracks on the rim being prepared from the back so as to avoid the accumulation of added metal between the teeth. About five hours was spent in preparing the various parts, and after setting up on a suitable support to maintain the sections in proper alignment, a charcoal fire was built around the wheel and allowed to heat for five hours, when welding was commenced. The cracks in the rim were welded first and the two arms afterwards, as this method assured more uniform contraction when cooling. The total cross sectional area united was approximately 80 sq. in., and the work was completed in nearly 14 hours. After being placed in position, a little chipping was necessary at some of the welded parts in the rim, but the time that the machine was out of service, due to repairs, was only a little over 30 hours. The cost of this job was $120, and when compared with an approximate cost of $150 for a new gear may not appear a remarkable saving, but when the delay that would have been entailed in getting a new gear was taken into consideration, the cost of the repairs was insignificant. Since repairs were made this gear has been in operation for nearly three years.

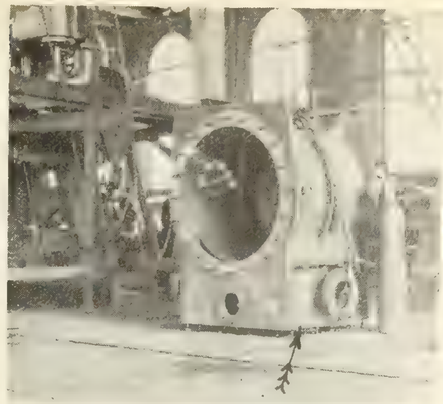


FIG. 3. LARGE MARINE ENGINE CYLINDER REPAIRED BY WELDING.

Locomotive Cylinder Repaired

Fig. 2 shows a large locomotive cylinder that was cracked near the end of the bore by the contraction of the metal during the casting of the cylinder. This defect was not apparent until considerable machining had been accomplished, and when discovered it was decided to have the broken part welded with the blow pipe. The crack, which extended for a length of about 28 in., was gouged out to form a channel for the metal that was added by means of a feed rod of cast iron. The portion surrounding the break was subjected to a preheating process for nearly five hours to bring the metal up to a dull red heat when the welding operation was commenced; the time for making the weld, including the time required to prepare the crack, occupied a period of about four hours. Owing to the position of the weld it was obvious that further machining was necessary to obtain an accurate finish on the bore. It is the work of this nature that emphasizes the importance of autogenous weld-

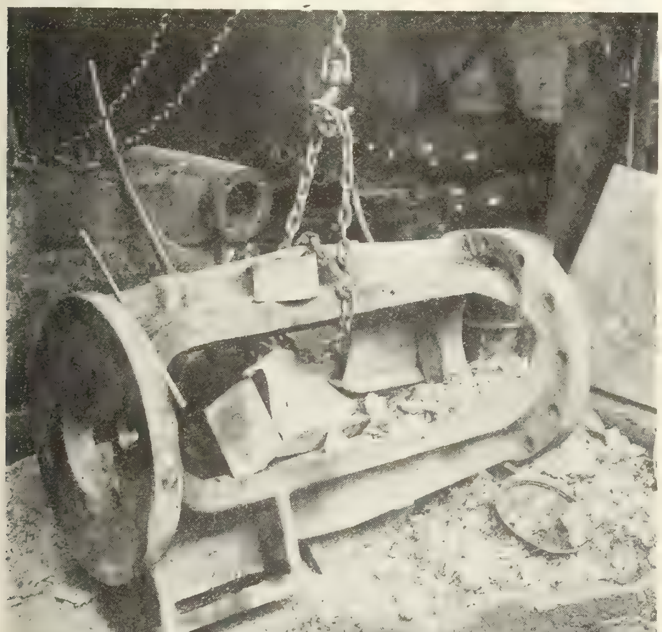


FIG. 4. CROSS-HEAD SLIDE OF HYDRAULIC PUMP WHICH WAS CRACKED THROUGH AT ONE END.

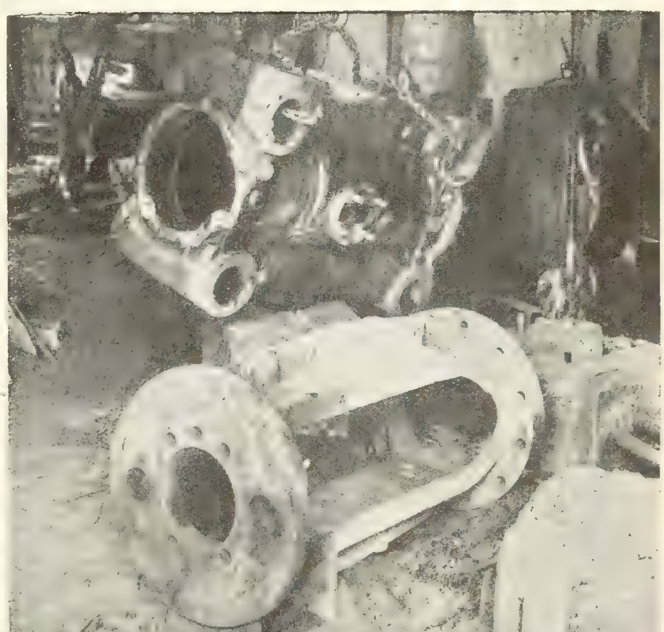


FIG. 5. SLIDE SHOWN IN FIG. 4, COMPLETELY REPAIRED. NOTE DAMAGED CYLINDER ABOVE WAITING REPAIR.

ing in reclaiming costly parts of machinery, and its value can possibly be better understood when it is known that the cost of repairing this particular cylinder was only $20, as compared against the cost of a new cylinder, which would be in the neighborhood of $250.

Break From a Defective Chain

The danger of handling large pieces of machinery by means of the crane is clearly illustrated in the cut shown in Fig. 3, which shows a large 30 x 30 in. low pressure marine engine cylinder that was dropped from its hanging support by the failure of a defective chain that allowed the heavy casting to collapse, with the result that the portion indicated by the arrow, having an approximate length of 14 in. and containing three studs, was broken out. This cylinder, with a weight of nearly four tons, had been practically finished and represented an approximate cost, including the machining, of about $900. To scrap this, therefore, meant no small loss, and in order to save it, the piece was welded in, the corner being heated by means of a charcoal fire, raising the adjacent metal to a red heat. The time required to repair this job, including the preparation of the parts, the preheating, and the actual welding, was just about 24 hours, at a total cost of $150. This being a portable job, the charge included the shipping of the welding outfit to and from the plant in addition to the actual cost of welding.

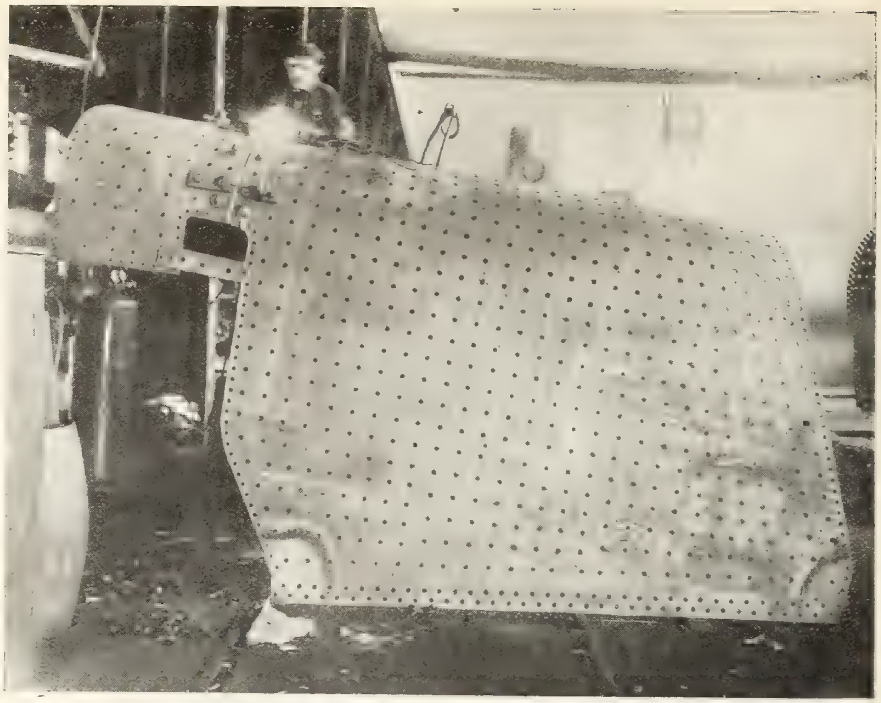


FIG. 7. PIECING UP A FIRE BOX BY AUTOGENOUS WELDING. A REGULAR OPERATION IN LOCOMOTIVE BOILER BUILDING.

Reclaiming a Crosshead Slide

With the probable exception of the automobile industry, it is doubtful if any line of manufacturing activity has been systematized to such a standard of efficiency as that of the making of shells, as practised during the past few years. Owing to the routine method of performing the various operations it was essential—especially where no auxiliary equipment was installed—that every machine be kept in good working condition throughout the entire 24 hours of the day, as the tying up of any of the equipment invariably resulted in disorganizing the regular movement of the product through the shop, with subsequent loss of time and curtailment of output. In the forging plant the main source of power is the hydraulic pumps that supply power to the accumulator for the operation of the presses, the stoppage of which for any length of time meant a shortage of forgings upon which the various machine shops were dependent. In a Montreal plant a short time ago, through a loose nut on the piston rod, the cross head slide of the high pressure hydraulic pump was broken. The cost of a new slide, approximating $350, was a matter of small moment under the circumstances, but the date of delivery, about six months, was out of the question entirely. It was, therefore, imperative that the piece be immediately repaired and it was decided to do this by the oxy-acetylene process. Upon delivery at the welding shop, the piece was at once prepared by cutting away the metal at either side of the cracks, which extended entirely through the metal where the slide joins the flange, as shown is Fig. 4, which is a view of the weld partly completed, the charcoal preheating fire at the time being partly scattered. The metal at the welded portion was about four inches thick and the approximate length, both sides, was 27 in., making a cross sectional area of nearly 110 sq. in. Before starting work with the blow pipe, the broken end of the casting was raised to a dull red heat by the charcoal fire, this taking about five hours. For work of this character, requiring continuous operation for long periods, it is the practice to use two welders to relieve each other. The welding of this crosshead slide was completed in about ten hours, and the time the pump was out of service, owing to the repairs, was 36 hours, at a cost of $110. Fig. 5 shows the casting finished, the Corliss engine cylinder above awaiting treatment for pieces broken out of the end.

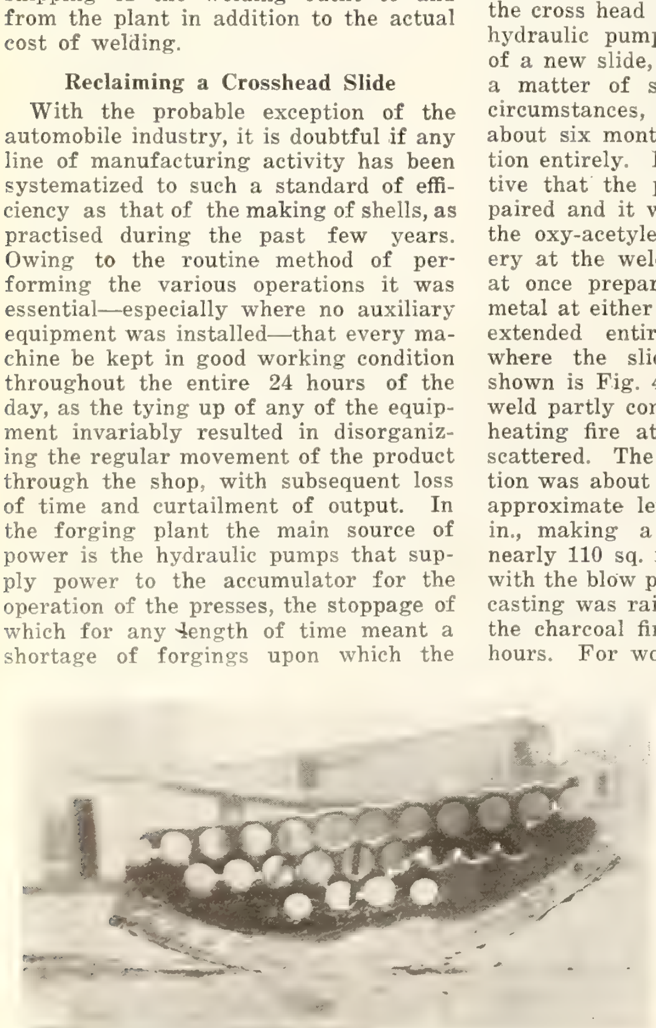


FIG. 6. DEFECTIVE TUBE SHEET CUT FROM PLACE IN LOCOMOTIVE BOILER.

Repairs to Locomotive Tube Sheet

A good illustration of what can be accomplished by the oxy-acetylene process of cutting and welding is shown in Fig. 6. This is a section of a tube sheet that was removed from a locomotive boiler by cutting out with the blow pipe. When this head had been made, it appears that an imperceptible flaw had been formed at the bend of the flange, which in a very short time developed into a serious crack. In an effort to save the sheet the crack was welded with the blow pipe as shown; soon afterwards, however, additional trouble arose, not only at the flange, but also at quite a number of the bridges between the holes in the tube sheet. It was

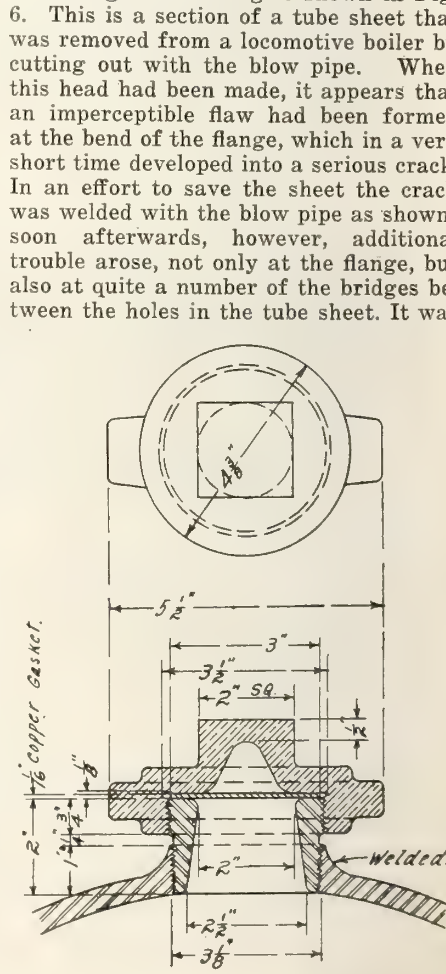


FIG. 9. SECTION OF PLUG SHOWN IN FIG. 8.

then decided to cut out the affected portion of the sheet, and also that section of the boiler shell adjoining. The diameter of the shell was 5 ft. 2 in. and the thickness of the tube sheet ⅜ in. The approximate length of the cut section was 5½ ft. and the piece was cut out in about half an hour; the new piece, exclusive of its preparation, was welded in position in a little over five hours by one welder and a helper. This job consumed 250 cubic feet of oxygen and a similar volume of acetylene, and was completed at a total cost of $70 portable job; only entailing a boiler shut down of about 48 hours, due to welding repairs. This tube sheet, after a period of three years, is still in good condition.

Boiler Construction

In the manufacture of boilers of every description the blow pipe is rapidly acquiring a permanent place. In Fig. 7 is illustrated a regular welding job on the section of the shell on one of the large Mallette articulated type of locomotive boiler. After the edges are beveled, which takes about fifteen hours, the extension is secured in position by suitable clamps, with the desired allowance of separation for expansion of the metal. The total length of the joint in this particular instance was 9 ft. 4 in., and the welding was accomplished in about 10 hours. Work of this character is performed at an approximate cost of $1.15 per ft. of length.

Special Washout Plugs

An interesting detail in the construction of boilers to which the blow pipe has been adapted, is the welding in of special wash-out plugs, as shown in Figs. 8 and 9. This particular design of plug eliminates the objectionable feature, so pronounced in the old type, of destroying the threads in the hole when using the muck bars for cleaning. The sectional view of the plug shows the method of applying the plug and also the reinforced section of added metal. The outer thread on the bush is cut large and finished to size after the bush has been welded in position. Between the cap and the bush a copper gasket is used to insure a tight joint. These improved plugs are applied to a boiler at a total cost of $10.

In the manufacture of superheaters and in refrigeration, short bends are often desired, and for this class of work the blow pipe is particularly adapted, as shown in Fig. 10.

FIG. 8. IMPROVED WASHOUT PLUG FOR LOCOMOTIVE BOILERS. IT IS WELDED INTO POSITION.

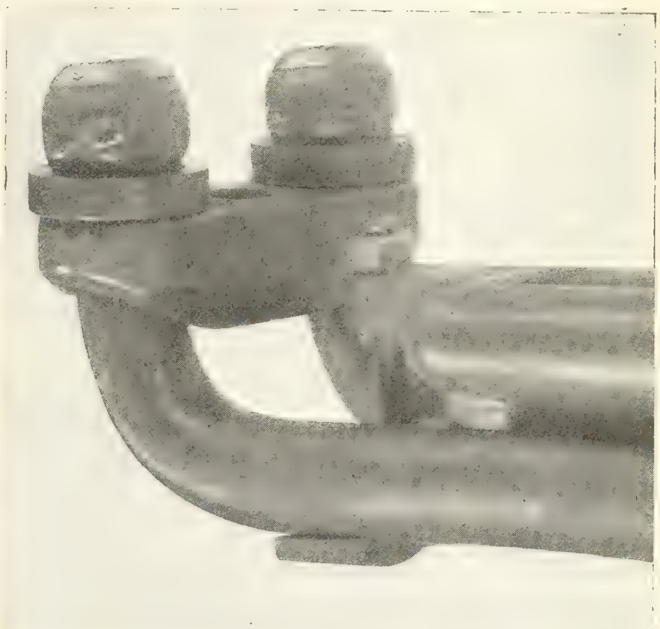


FIG. 10. SHORT BENDS IN SUPER-HEATER PIPES MADE BY OXY-ACETYLENE BLOWPIPE.

FAILURE OF BOILER PLATES

THE causes of failure of boiler plates in service, and particularly in marine service, are of the utmost interest, and in raising this question before the Iron and Steel Institute Dr. E. B. Wolff succeeded in eliciting the opinions of some of the best authorities on the subject. The particular case taken as an example in the paper was an explosion caused by the shell plate of the boiler having burst open in the middle of the double butt strap joint at the side, and had the accident occurred when the ship was at sea it would probably have added another to the list of marine tragedies. It is a fortunate circumstance that in spite of the large number of marine boilers in service, roughly estimated by J. T. Milton, the Engineer Surveyor of Lloyd's Register, at 50,000, and although these are of all ages, the case described in the paper is practically the only instance on record of a marine boiler bursting with disastrous effect while in service. Mr. Milton himself knows of no other case, and C. E. Stromeyer, another well-known authority, who was formerly an official of Lloyd's Register, was able to confirm the statement.

A point raised in the discussion referred to the fact that the plates of the boiler which exploded were probably of basic steel, whereas acid steel has been almost invariably employed for boiler plates, at least until recent years; and it was hinted that failures which have occurred in shell plating may be the result of using steel made by the basic process. The probable cause assigned for the failure of the boiler plate which was the subject of discussion was the fact that in Continental practice boiler plates are annealed, and that by reason of the custom of annealing them in batches those in the middle of a batch so treated are subject to uneven heating, which leads to the development of defects that may cause failure in service. This view is to a certain extent confirmed by the fact that the trouble experienced with boiler plates is invariably round the edges, which are the part of the plate which would tend to be overheated by the annealing methods adopted; but it is the fact that plates whics have not been subjected to annealing have failed in the same way.

Great Lakes Navigation Close.—It is expected that navigation on the Great Lakes will close about November 26. According to information received by the general freight department of the Canadian Northern Railway, the last steamers of the Great Lakes Transit Corporation, carrying package freight, will clear from Cleveland on Thursday, November 15, and from Buffalo, N.Y., on Monday, November 26. The boats will run to all Lake Superior ports, including Duluth and Superior. Shipments of freight made from eastern United States on and after November 1 and routed via the Great Lakes Transit Corporation will only be accepted subject to all-rail rates in event of the lake lines being unable to handle the traffic.

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Vol. VII OCTOBER, 1917 No. 10

PRINCIPAL CONTENTS

STANDARDIZATION, ITS POSSIBILITIES AND PROBABILITIES

CURRENT events continue to afford evidence that the theory of standardization carried to a logical and common sense extent will be the saving grace of the world, industrially, and in a sense militarily, not only during the stress of present conditions, but for an indefinitely long period in the future.

When the question of standardized ships was first mooted, it was viewed in the light of an emergency measure only and its future development was not accepted offhand as a definite probability of any great magnitude, but the putting into commission of the first British ship of this description has been the occasion for an expression of expert and authoritative opinion which leaves no doubt as to the possible developments of the theory. Not that the theory is new, or that its present application is on such a scale that its success could have been seriously questioned. The real point at issue was whether the individualism of British shipbuilders and shipowners could be completely put aside under stress of national necessity and every available effort put forth toward producing a need of the moment.

The answer to all the critics, for and against the policy was afforded on August 30, on which day the authorities in Britain announced their satisfaction with the initial production. Every yard, the Shipping Controller stated, was full of standardized ships, and while the first of the fleet had been built in practically five months, it was expected that similar vessels would be turned out in four or four and a half months. One personage stated that while quicker immediate results, in some cases at least, might have been obtained by a repetition of customary designs, for such a purpose as the authorities had in view, standardization held the field, as obviously it made possible standardization of ship material which would not be possible if shipowners were merely repeating their usual designs.

The success attending the British materialization of the standard ship idea lends further interest to the United States' efforts which are now being put forth, and likewise draws attention to the work being executed throughout the Dominion. In our case, as in that of Britain, detailed reference to localities and builders is not possible at this time, but the particulars of ships' engines published in this issue are evidence that "something" is being accomplished.

It must not be supposed, however, that such developments foretell the possibility of the great majority of manufacturing efforts being reduced to a plane of repetition. As a matter of fact, all past evidence seems to indicate that one result has been an increasing keenness of competition, more alertness for improved production methods, wider and more systematic search for new materials, and an all round effort to give more value for money received.

The classic instance of such industrial development is the automobile. The adoption of standard dimensions, materials and types has had no apparent restrictive effect on the initiative energy of designers. Changes in external appearance are largely a matter of fashion, but back of all there continues a steady effort at research, design improvement, and productive efficiency which has made the industry a standard of international comparison in most industrial discussions.

The lesson of the motor car has its bearing on all the other vital questions of the moment. Standardization has had no more debasing effects on it than the standard keyboard has had on pianos and typewriters. Ships' dimensions and scantlings are ripe for such treatment, and the idea expressed in many handbooks that every ship is an experiment has been disproved absolutely and for all time.

CANADIAN MARINE "HEADLIGHTS"

CHARLES EDWARD FRASER, B.A. Sc., president, Fraser, Brace & Co., Ltd., Montreal; president, Fraser, Brace & Co., New York; managing director, St. Maurice Construction Co., was born in Montreal, April 7, 1873.

He was educated in public schools, Montreal, and graduated from McGill University (Bachelor of Applied Science), 1899.

Supervised construction of a section of the first New York Subway, 1900-1904; also half of the construction of four tunnels for the Pennsylvania Railroad under the East

CHARLES EDWARD FRASER, B.A. Sc.

River, New York, 1904-1908. In 1908 established the firm of Fraser, Brace & Co., New York, which company have carried out a large number of notable undertakings.

In Canada: Intake section of the Canadian Light & Power Company's power development at Valleyfield, 1910-1911; construction of the Cedar Rapids hydro-electric development, 1913-1914. In the United States; Viaduct construction for the Pennsylvania Railroad, 1909; shaft and tunnel at Niagara Falls, 1908-1910; two hydro-electric developments on the Deerfield River, Mass., 1912-1913; construction of four miles of flooring on the Hell Gate Bridge, 1915-1917; construction of cantonment for the United States Navy, Philadelphia, 1917; construction of shipbuilding yards at Newark for the Federal Ship Building Company, 1917.

In 1914 the Canadian firm of Fraser, Brace & Co., Ltd., was established and have constructed a smokeless powder plant at Trenton, Ont., for the Imperial Munitions Board, 1917. Construction work now under way; Dam at La Loutre, Que., on the Upper St. Maurice River; a second power development at Cedar Rapids; four wooden steamers for the Imperial Munitions Board at Montreal.

Mr. Fraser is a member of the Canada Club and Engineers' Club; member Can. Soc. Civil Engineers; member Am. Soc. Civil Engineers; and in creed is Congregational. He married Helen Sweezy, daughter of Richard L. Sweezy, their family consisting of two sons and one daughter.

Mr. Fraser's residence is 466 Roslyn Ave., Westmount, Que.

—Photo, courtesy British and Colonial Press.

New Development in Ships' Watertight Door Construction*

By I. Toro **

The object of the system of water-tight doors here described is to allow of easy communication between one compartment and another, also to provide means of escape from one compartment to an adjoining compartment without allowing the water-tightness of the bulkhead to be impaired. Several arrangements have been invented with these aims in view.

THE introduction of water-tight doors for ships was a necessity which arose when water-tight bulkheads came to be fitted, in order to give ready access to compartments which contained the machinery, or other compartments to which it was deemed desirable to get access periodically for inspections, and yet have efficient means readily available to isolate these in emergency. The necessity demanded the invention of a system which could be readily available when the moment arrived to close the doors.

General and Operation Features.

In this system an opening is cut in the bulkhead, and to this opening is fitted, in a water and air tight manner, a chamber or cell of rectangular or other suitable shape; this cell is formed by two rigid cast steel frames of the required dimensions, to enable one or more men to move about in the cell. The chamber has two openings, one at each side, through which men can pass, and each of these openings is fitted with a sliding door adapted to slide in ways to and from the seat, so that, when open, there is a clear entrance into the chamber, or, when closed, a wedge-shaped edge on the door enters between correspondingly shaped faces or into a recess in the seat or sill of the opening thus forming a water-tight joint to prevent leakage and render the door self-packing. These doors are operated hydraulically, but they could also be worked pneumatically, electrically, or otherwise, in such a way that under no circumstances whatever can both be opened at the same time, one door remaining open when the other is closed and vice versa, or both remaining closed.

As the gear for operating both doors is similar, in the following description we shall refer to one door only, except where the gear of one door interferes with that of the other. A convenient method of operating the doors is by means of a rack or racks on each door operated by pinions keyed on a shaft. In the case of hydraulic power being used, a hydraulic cylinder is provided fitted with a piston whose piston rod has a rack gearing with a pinion keyed in a shaft which has another pinion gearing with a rack on the door, so that by admitting pressure to one side of the piston in the cylinder and putting the other side to exhaust, the door is opened or shut according to the direction in which the pressure acts. Pressure to open the door should be admitted at the top end of the cylinder.

Hydraulic Operation

The controlling valve for the hydraulic cylinders can be operated from the inside of the chamber or cell by means of a pair of hand levers, or from the outside of the chamber by similar levers, the said levers being adapted to control ordinarily the respective doors. The working lever is of the bell-crank type, and is connected to the lower end of the spindle of the controlling valve. The doors are so arranged that one must be completely closed before the other can be opened. To fulfil this condition, certain appliances, which vary according to the gear used to operate the doors, are provided; in the case of hydraulically-operated doors, an intercepting valve in connection with each door is provided, this valve being worked by the door in such a manner that when one door is opened fluid pressure to open the other door cannot reach the hydraulic cylinder. The intercepting valve may, if desired, be fitted in the top of the chamber, its spindle being connected to a bell-crank lever, one of whose arms is operated by a cam fitted on the top of the door in the rear, and so arranged that only when the door is perfectly closed the cam would move the spindle of the valve to allow a free passage between the controlling valve and the opening end of the cylinder actuating the other door.

The chambers of the intercepting valve are connected respectively by pipes with the hydraulic cylinder that operates the other door, and with a port in the chest of the controlling valve that operates the said hydraulic cylinder, so that the pressure fluid on being admitted by the controlling valve passes through the pipes by way of the intercepting valve of one door to the hydraulic cylinder of the other door. The chambers of the intercepting valve of the opposite door are similarly connected, so that the opening of one door keeps the other closed and vice versa. If, therefore, one of the doors be opened, the act of opening will release its intercepting valve spindle, so that such intercepting valve closes by the pressure of the spring and cuts off any admission of pressure fluid into the hydraulic cylinder of the other door. It will be seen, therefore, that if one door be open and the other closed, the operation of the lever to open the closed door would have no effect, because the intercepting valve would be closed and pressure fluid could not reach the hydraulic cylinder to open that door. When both doors are closed, then either lever can be operated to open one door or the other.

Simultaneous Opening of Doors Avoided

To prevent both doors being opened simultaneously, there are certain locking devices provided which consist of locking bolts, coupled either directly or through the medium of rocking arms and levers with the opposite hand levers, such locking bolts being adapted to lock the valve spindles under certain conditions, that is to say, when both doors are closed, the locking bolts are in the "off" position, but when one or other of the controlling levers is operated, the locking bolt connected therewith is shot forward into slot cut in the valve spindle of the other controlling valve so as to lock it and prevent it being operated. It will be seen that the locking bolts provide also a device which prevents in any case one door being opened while the other is open, as the slots cut in the spindles are only exactly in front of the said bolts when the levers of the controlling valves are in the shut position, that is to say, when the doors are closed. When one door is open the slot of the controlling valve spindle is moved from its original position, the passage being intercepted by the solid part of the spindle, so that the lever of the other door cannot be moved from the closed or shut position, as the locking bolt connected to it has its travel barred by the spindle of the other controlling valve. Should one or both of the intercepting valves not work as intended, this mechanical device provides a further means of preventing both doors being opened at the same time. Moreover, if desired, the use of the intercepting valves could be dispensed with and only the locking bolts used. Thus one door must always remain shut, and in no case could there be a through passage from one compartment on one side of the bulkhead, or partition, to the other side thereof.

Compartmental Transfer

The working of this system of doors in order to get from one compartment to another is as follows:—The door at one side of the chamber or cell is opened first by means of the outside controlling lever to allow the man or men to gain admittance to the cell. This door is then closed by one of the controlling levers inside the cell. When this is properly closed, but not before, the opposite door can be opened by the other controlling

*Institution of Marine Engineers Paper.
**Engr.-Lieut. Chilian Navy, Member.

lever, enabling the men to obtain admission into the other compartment. In no case can there be a through passage from one compartment to the other, as one door must always remain shut.

In ordinary circumstances each door may be controlled from its respective side, but as it may happen that the panic-stricken men rushing from a compartment where there is danger to the adjoining compartment might easily forget to shut the door of the safe compartment, thus preventing other people from escaping, an emergency arrangement is applied which permits of the controlling of the doors from the opposite compartment; the lever besides being connected to the rocking lever that works the locking bolt is connected also to an arm pivoted on a shaft which is fitted in a water-tight and air-tight manner through the side of the chamber; in the outside end this shaft has keyed to it an arm, fitted with a handle and also with an index which works between the positions open and shut. In this manner the possibility of leaving men locked in a compartment is therefore prevented, as by means of the arm the controlling valve of the opposite door can be worked, and therefore this door can be closed to allow the opening of the other door. If necessary, a device may be applied to give a signal of the completion of the operation of passing from one compartment to the other.

Bridge Control Unnecessary

The controlling valves could be of the ordinary type, but the inter-locking device might, I think, be applied to some of the patented valves that can be operated from the bridge. In my system there is, however, no need of this control from the bridge, as under no circumstances whatever is there a through passage from one compartment to another; in fact, it may be said, as far as the efficiency of a water-tight sliding door permits, that the bulkhead is intact.

In connection with the use of doors in the bulkheads of warships, the naval authorities do not allow their application, although they recognize the difficulties under which the engineering force has to work to obtain full efficiency from machinery placed in isolated places, not always run by careful hands, but the naval authorities consider that where there is a door in a bulkhead, there is a hole. All this may be applied to single doors, as in the moment of danger a plank of wood, a shovel, or any other article might be left in the door, which would prevent it from closing, but with my system such a thing is impossible, as there must always be one door closed, and, therefore, the bulkhead is always water-tight. In merchant ships doors are allowed in bulkheads; with this system of double doors which are fool-proof, the safety of such ships would be considerably increased, as, for reasons already stated, the bulkheads would always be water-tight, notwithstanding that there would be easy means of communication between the different compartments. I think that this system of doors is fool-proof and able to fulfil the demand of always maintaining the water-tightness of the compartment.

UNSINKABLE SHIPS—THE FACTOR OF STABILITY

SOME six years ago or so a good deal was heard about the unsinkable ship. The unfortunate disaster to the *Titanic*, coupled with the large number of ships that have been sunk during the war, has been more than sufficient to shake the faith of any who might have had a belief in the possibility of building a ship so that she would be unsinkable. Although it was thought some few years ago that it might not be possible to build a merchant ship so that she was unsinkable, yet at the same time the opinion was held that warships, with all their complicated subdivision, would be practically unsinkable. It has now been abundantly demonstrated that warships can be sunk by mine or torpedo.

The subject of unsinkable ships is not, however, specially featured in this article, the main purpose of which is to consider damage to ships in its relation to their ability to remain upright after receiving damage. It is, nevertheless, somewhat strange to find that there are many people at the present day who still continue to put forward all kinds of proposals for rendering ships unsinkable, and a few words on the subject may, therefore, not be out of place.

Buoyancy

A ship will always remain afloat provided she has reserve of buoyancy—that is to say, so long as the weight of water that would be displaced by the total volume of the ship is greater than her weight. It will help matters to consider two extreme cases. If a solid homogeneous log is just floating in water it stands to reason that any part or parts of it can be destroyed without the remainder sinking. On the other hand, if an empty shell is just afloat in water, any break in the shell, however small, will be sufficient to cause it to sink. A ship is neither a solid log nor an empty shell, but is something between the two. A ship is a shell, inside of which are all kinds of fittings, such as the structural parts, the passenger equipment, and the cargo. Every ship floats with a certain amount of reserve buoyancy, and if at any time that reserve buoyancy is destroyed the vessel is bound to founder.

In the ordinary way, if some of this reserve of buoyancy is lost, the remainder will keep the vessel afloat. It follows, therefore, that any vessel can stand a certain amount of damage without being sunk. It would be theoretically possible to fill a ship throughout with some buoyant material so that it would be almost impossible to sink her. All ships, however, are built to perform certain functions, and the space inside them is not available for the carriage of buoyant material. In the older battleships the expedient of filling certain spaces with buoyant material was actually adopted, the forward compartments of these vessels being filled in this way. It is for this reason that cargo vessels have a better chance of surviving damage than passenger vessels, since the cargo itself is, generally speaking, of buoyant material, whereas there is very little material in the passenger spaces which contribute to the buoyancy.

Watertight Subdivision

As it is not possible to fill a ship with buoyant material, the next best thing is to subdivide her by watertight divisions, so that any damage received to the shell is limited in extent. There are, however, drawbacks to this expedient. Even in a warship the spaces cannot be made indefinitely small, and in a merchant ship they must of necessity be large if the vessel is to be a good commercial venture. It is put forward from time to time by inventors and others that the spaces between the frames and the beams under the decks should be filled with buoyant airtight vessels. Such an arrangement is doomed to failure from the start. If the shell of a ship receives damage either by explosion of a mine or torpedo, or from collision with another ship, any such airtight vessels would be destroyed if placed between the frames. Further, the airtight spaces that did remain intact would be of use only in the compartment or compartments which were flooded. Calculation shows that the filling of the spaces between the frames and beams would give buoyancy to the ship only to the extent of about 5 to 10 per cent. of the volume of the compartment so treated. Deductions must be made from this for the airtight compartments destroyed, as already pointed out, so that the contribution to the buoyancy of the ship would be very small.

Adequate watertight subdivision is undoubtedly the best method to adopt, but even this must be very carefully worked in conjunction with the other properties of the ship, such as heeling fore and aft, and transversely. In any case, it seems out of range of practical politics to subdivide merchant vessels adequately in this way unless in the extreme case special vessels should be set apart for carrying passengers only to the exclusion of cargo, the cargo being carried in vessels specially adapted for the purpose, with no passengers. Even such vessels would survive only moderate damage.

The attitude now taken up by all responsible naval architects is a recognition of the fact that it is possible to sink any ship, provided the damage is extensive enough, and that the only reasonable course to pursue is to take precautions so that a vessel will not be easily sunk by moderate damage. There is one aspect of this matter, however, which does not yet appear to have received the attention it deserves. The usual method of procedure is so to subdivide a ship that, when she has received damage to a certain extent, which is usually arbitrary, she will have sufficient reserve of buoyancy to withstand it. It does not follow that this in itself is sufficient. Another important consideration is the stability of the ship when undamaged and the amount

of stability she will lose on receiving damage.

Capsizing

Before the war, all the evidence taken by the committee appointed by the Board of Trade to consider the subdivision of ships showed no instance of merchant vessels capsizing after damage. Since then there have been numerous instances where merchant vessels have capsized. Such cases are often explained by the presence of longitudinal subdivision in the ship in addition to the ordinary transverse subdivision. When a ship has a bulkhead fitted at some little distance from the side of the ship and running practically parallel with it, it follows that, if she receives damage, a volume of water will be admitted to one side only, which will naturally heel her over. In the ordinary way, the stability of a merchant ship is not great enough to withstand this treatment, and she naturally capsizes.

Tranverse Subdivision Only

When, however, a ship has transverse subdivision only, she may still lose stability when damaged. When the side of a ship is breached, an area of waterplane becomes open to the sea, and it may be of sufficient size to cause the stability to become negative, with the result that the ship heels over and possibly capsizes. It is undoubtedly true, and incidentally fortunate, that generally when the damage received is not sufficient to sink the vessel bodily her stability remains positive. Should, however, the damage be so extensive as to destroy the reserve of buoyancy, it will often happen that so much stability will be lost as to cause the vessel to heel over and sink. This causes her to founder much more quickly than if she sank bodily.

If a vessel is bound to sink as a result of damage, the longer she takes to do so the more chance there is of saving the lives of those on board, and, in consequence, anything that can be done to prevent capsizing is of great value. Once a vessel begins to heel over all the openings on the side give free access of water to the interior. This rapidly increases the heeling and further reduces the reserve of buoyancy. It is next to impossible for the passengers and crew to keep their feet except at very small angles of heel, and in consquence the task of launching the ship's lifeboats becomes almost impossible. This has been exemplified in several cases recently, notably those of the *Empress of Ireland* and the *Lusitania*.

It has already been remarked that it is possible even when a vessel has transverse subdivision only that she may capsize when damaged. The provision of adequate stability in the ship when in an average loaded condition is, therefore, important, and should be considered in connection with the subdivision. It is somewhat remarkable to find that the loadline rules and the Bulkhead Committee regulations make no provision for the transverse stability of vessels. This circumstances is probably accounted for by the fact that rules for this purpose would be extremely difficult to draw up. Nevertheless, it is a matter to which the designer of a ship should give particular attention, especially as every case has practically to be considered on its merits.

Passenger and Cargo Ships

In the case of passenger steamers, the water level inside the ship after she has received damage will generally be in a passenger 'tween deck, where the fittings will hardly contribute anything to the waterplane area. The loss of stability in such a case is, therefore, greater than with a ship mainly carrying cargo. If the water level after damage is among cargo, the cargo itself will prevent the loss of a great deal of the waterplane, and accordingly the loss of stability will not be so great. This fact points to the provision of a greater amount of initial stability in passenger ships than in cargo vessels, a view which has been borne out by experience obtained during the war.

Formerly it was always considered desirable for passenger vessels to have a small amount of stability in the average condition, so that they would roll easily in a seaway. Apart from other disadvantages, small stability carries with it, as will be seen from what has been said, the consequence that the safety of the vessel may be reduced. In the larger type of passenger liners it has by no means been demonstrated that a very small amount of initial stability is necessary for comfort in a seaway, and there is every reason for anticipating the provision of more stability in passenger ships in the future than there has been in the past.

Objection to Longitudinal Subdivision

The objection to longitudinal subdivision in merchant ships is that generally it causes unsymmetrical flooding and, therefore, capsizes the ship, but here again the question is one of the provision of adequate stability. It is quite possible to provide a ship with such a large amount of stability that even if she is fitted with longitudinal subdivision she need not capsize. It goes without saying that such a vessel would be forced to have a far greater amount of initial stability than anything that has been provided in the past. It would certainly bring with it disadvantages, but they would have to be looked upon as penalties for increased safety at sea, and as such would not necessarily be serious. At any rate, it is safe to say that the question of unsinkability of ships is closely connected with their stability, and that in the future ships will be relatively wider than in the past.—*Times Engineering Supplement.*

U. S. SHIPBUILDING PROGRAM

A CAREFULLY revised table showing the shipping facilities upon which the United States and its allies may depend during the next eighteen months or more to fight the German submarine was issued at Washington, D.C., on Sept. 26, by the United States Shipping Board.

Differing slightly from a statement earlier in the day by the Committee on Public Information, the table shows that the Government has under construction in dead-weight tonnage, including 400 vessels of foreign ownership which were requisitioned on the stocks, approximately 1,036 cargo vessels of 5,924,700 tons capacity. Most of these vessels will be completed by the end of 1918, and some of them will be off the stocks within sixty days.

These vessels have actually been contracted for. Congress, it was pointed out, also has before it a bill asking for funds with which to construct or purchase approximately 5,000,000 tons dead weight which will be completed in 1918 and 1919, raising the total of new construction under contract and the prospect to 10,924,700 tons dead weight. Reduced to gross tonnage this represents approximately 7,283,000 tons.

The statement issued by the Committee on Public Information showed that the Government now has in service for foreign trade 458 ships with an aggregate dead weight tonnage of 2,871,359 tons, not including 117 ships of German and Austrian origin totaling 700,285 tons, thus giving a grand total available for service to-day of 575 vessels of 3,571,644 dead weight tons. In June, 1914, the statement read: the available tonnage of the United States was only 1,614,222 tons.

The Shipping Board statement therefore shows as actually under construction or contemplated ships totaling 10,924,700 dead weight tons, or approximately 7,283,000 gross tons.

MOTOR SHIPS SHOW HIGH FUEL ECONOMY

RECENT official figures regarding performances of oil-fired vessels fitted with geared turbines, and motor ships of similar power show that the fuel consumption of the latter, per brake horsepower hour is still much less than that of steam driven vessels of high economy.

During the trial trip of the Edward Luckenback which was recently constructed by the Fore River Shipbuilding Co., Quincy, Mass., fuel consumptions were obtained as under:

B.H.P.	Lbs. of oil per B.H.P. hour
3250	0 98
3750	0 98
4150	1 00

This vessel is 456 ft. long with a gross tonnage of 8,150. She is fitted with a Curtis turbine developing 400 brake horse-power at 2,400 rev. per min. The propeller is geared to run at 90 rev. per min, the respective speeds of turbine and propeller being thus conducive to maximum efficiency.

A suitable subject for comparison with this vessel is the motor ship Fionia which is driven by two four-cycle Burmeister and Wain engines of 3,500 brake-horse-power. These engines operate with a consumption of fuel not exceeding 0.37 lb.,—about 36 per cent. of that of a modern steamship and equal to a saving of 64 per cent. in the total cost of fuel.

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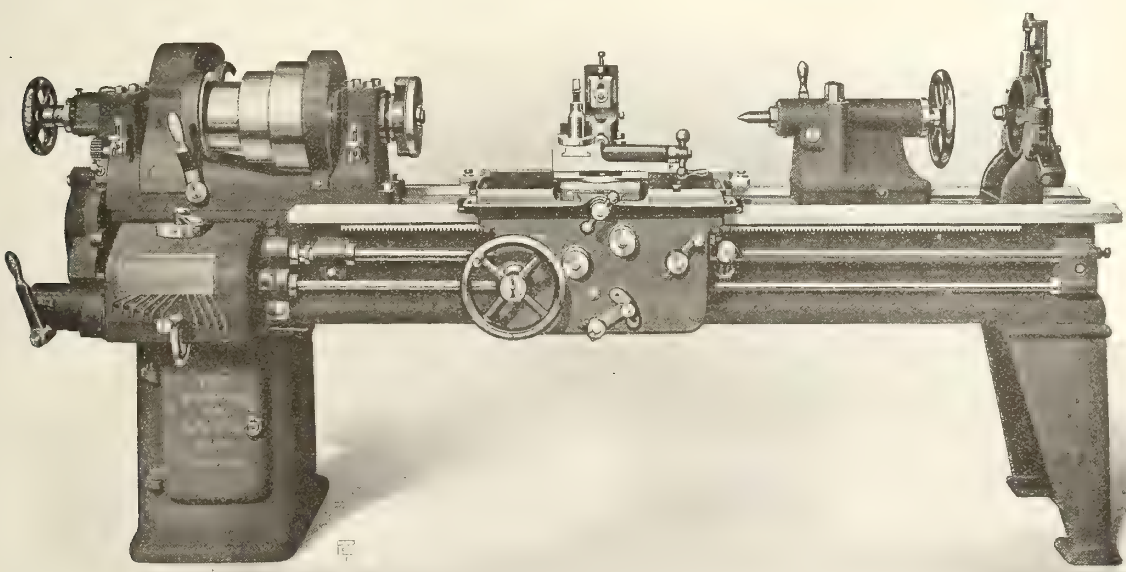

ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Commodore Aemilius Jarvis, S.S.D., has been appointed president for all Canada of the British and Foreign Sailors' Society, in place of the late Lord Strathcona and Mount Royal.

Arthur S. Leitch & Co., Toronto, have been appointed Ontario representatives for Mason Regulator and Engineering Co., (formerly H. L. Peiler & Co.), Montreal, who recently closed their own office in Toronto.

Percy C. Brooks, vice-president and manager of the Canadian Fairbanks-Morse Co., Toronto, has been appointed president of the E. & T. Fairbanks Co., scale manufacturers, St. Johnsbury, Vt., in succession to Frank H. Brooks, who has resigned.

R. V. H. Keating, of Port Arthur, Ont., has left for Windsor, Ont., where he will spend some time as resident engineer on the large contract which the Great Lakes Dredging Co., of Port Arthur, has obtained at Ojibway for the Canadian Steel Corporation.

Francis H. Sheppard, M.P. for Nanaimo, has been selected by the Dominion Government, it is understood, for the position of inspector of dredging for British Columbia. Mr. Sheppard is an engineer by profession. He has had considerable experience in mining engineering in Canada, Australia, New Zealand and Alaska, and in railroad construction in British Columbia.

Wm. Rodger, for the past year construction engineer with Fraser, Brace and Company, has resigned his position with that firm and has started business for himself as a lumber broker, specializing in ship and heavy timbers. He has the contract for supplying the timber for two of the ships now building for the above mentioned firm. Mr. Rodger has offices in the McGill Building, Montreal.

John Hay, who for the past three years has been in the nautical instrument business in Toronto has been placed in charge of the new plant which Scythes & Co. have fitted on Church street for manufacturing and repairing nautical instruments.

James G. Lorriman has been appointed manager of the Marine Specialty Branch of Brandram-Henderson Ltd., paint manufacturers, Montreal, etc. Mr. Lorriman was, for four years, sales and advertising manager of the Metal Shingle & Siding Co., Preston, Ont., and has been connected with the MacLean Publishing Co. in their Montreal and Toronto offices for nine years, during the past six of which he was business manager of the weekly publication *Hardware and Metal*. In connection with this appointment, it may be of interest to note that the earliest efforts of Brandram-Henderson Ltd. were directed to the manufacture of paints specially adapted to marine work, and the creation of a special department with Mr. Lorriman in charge is expressive of the firm's determination to still further develop and intensify this feature, particularly as a more or less bright future is in prospect for a Canadian shipbuilding industry of substantial proportions and permanency. Mr. Lorriman's headquarters will be in Montreal.

W. H. Lynch, the new manager director of Canadian Vickers Ltd., Montreal, was, previous to acceptance of same, a director of Richardson, Westgarth & Co., West Hartlepool, England. Mr. Lynch, we understand has already established a considerable reputation for himself not only in Canada but in the United States as well. His appointment foreshadows that, following the war, and strongly backed by the parent enterprise in England, the operations of Canadian Vickers will be carried out on a gigantic scale. The enormous development programme prepared and gradually being unfolded includes the establishment and equipment of engineering works of various kinds both on our Eastern and Western seaboards. The headquarters plant at Montreal exemplifies one of the most remarkable phases of shipbuilding and marine engineering enterprise that could fall to the lot of any country to possess, and to its establishment, more than to anything else will Canada owe the rejuvenation and extension of her one-time achievement in the dual crafts.

LICENSED PILOTS

ST. LAWRENCE RIVER

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION

President—A. A. Wright, Toronto. **Secretary**—Francis King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE

Chairman—W. F. Herman, Cleveland, Ohio. **Secretary**—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA.

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer,** J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA.

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

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J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

1917 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand,	93 Fifth Avenue, Lachine, P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	176 King Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	436 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

MARINE NEWS FROM EVERY SOURCE

Sarnia, Ont.—While en route to Windsor on October 15, the steamer Hamonic broke her propeller, and as a result went into drydock at Detroit next day. The boat hit some obstruction.

Tug Sinks With Coal Cargo.—The tug Shaw, owned by the Cleveland-Sarnia Saw-mills, sank in the bay, Sarnia, October 21, after taking on a cargo of coal.

For Ocean Oil Carrying.—The Reginolite left Sarnia on October 24, for Montreal, where she will enter the oil-carrying trade between Peru and Halifax. She will return to the lake service of the Imperial Oil Co. next spring.

Bonus to Shipyard Employees.—Employees of the Port Arthur Shipbuilding Co. will receive a five per cent. bonus with each pay cheque from date, October 17, the company making the addition to the wages voluntarily.

Victoria, B.C. — The five-masted schooner Malahat, built by the Cameron-Genoa Mills Co., will make its maiden voyage as a sailing ship, owing to the non-arrival of the auxiliary engines. They will be installed on the completion of the first voyage.

Fort William, Ont.—Grain in elevators at Fort William and Port Arthur, on October 20, aggregated 12,764,061 bushels, as compared with 11,767,126 bushels a year ago. Receipts during that week were 9,896,399 bushels, and shipments 5,636,625 bushels.

To Build Wood Ships.—The International Shipbuilding Corporation has begun the erection of an extensive plant for wooden vessels at Nordin, on the Miramichi River. The first keel will be laid in a short time, says a Newcastle, N.B., despatch.

Shelburne, N.S.—The new steamer Keith Cann was launched on Sept. 18 at the shipyard of the Shelburne Shipbuilders Ltd. The vessel was christened by Miss M. Cann, daughter of Chas. W. Cann of Yarmouth, N.S. The Keith Cann is 130 ft. long, 25 ft., wide and 11 ft. 6 ins. deep.

To Float the Graham.—The contract for floating the steamer George A. Graham, wrecked at Manitoulin Island, has been awarded to the Reid Wrecking Co. The wreckers are to deliver the boat and cargo in port for the lump sum of one percentage basis underwriters' option. The contract is on the "no cure, no pay" plan, the wreckers getting nothing if they fail. The Graham is in bad condition, it is stated, having broken in two, but a large part of the grain cargo can be saved. The boat was formerly the Marina.

Sarnia, Ont.—The Government lighthouse tender Dollar on October 24 unloaded a cargo of empty oil barrels at the local refinery, and left later with a full supply for lighthouses and lights in Lake Huron and Georgian Bay. The former tender Simcoe has been sent to coast service.

Gale Damage at Port Colborne.—A heavy gale from the west, the first heavy storm of the season, struck Port Colborne about noon October 12. Trees were blown down and the steel ore bridge No. 1 at the Canadian Furnace Co. plant was damaged to the extent of $80,000.

Sherbrooke Firm Gets Marine Contracts.—It is understood that the firm of MacKinnon, Holmes & Co., Sherbrooke, Que., have recently received from the Imperial authorities a large order for marine work which will keep their plant in operation for many months to come.

Oshawa, Ont.—The Department of Public Works, through J. M. Wilson, district engineer, has notified G. D. Conant, Mayor of Oshawa, that work will be at once proceeded with for the purpose of making the wharf at Oshawa harbor available for the landing of coal next spring.

Canal Navigation Delayed. — Navigation was delayed a few hours on September 27, on account of the second section of the steamer Soukaheras sinking in Lock 9, Welland Canal. The water was drawn off the lock, and after repairs were made, the vessel proceeded on her way to Montreal.

Crew of Meaford Get $500.—Geo. E. Fair, managing director of the Farrar Transportation Co., Toronto, has received a cheque for $500 from the Department of Naval Service, Ottawa, for distribution among the crew of the SS. Meaford for sinking a German submarine in the Mediterranean on June 12th of this year.

Vancouver, B.C.—There is not the remotest chance of the C.P.R. taking over the Pacific Great Eastern Railway, according to F. W. Peters, general superintendent of the C.P.R. He also declared that his company has no intention whatever of building any drydock in Vancouver or at any place on the Pacific Coast.

McVittie is Released. — The steam-barge McVittie, westbound, which ran on a shoal, Sunday, Oct. 14, was released the following Friday. Three tugs and a diver were brought to the scene. The craft has a large hole in the hull, and will have to be drydocked for repairs. Part of the cargo was lightered.

Sarnia, Ont.—The Sarnia Bridge Co. have been awarded the contract for the erection of a large gantry crane for the Playfair interests at Midland, Ont. The tower will be 40 by 40 feet square, with cantilever arms 87 feet long, and the total length of the crane will be about 216 feet.

Port Dover, Ont.—A large delegation of businessmen and manufacturers in this district who came here recently to inspect the harbor, passed a resolution urging upon the Dominion Government the necessity of improving the present slip for docking facilities at Port Dover, to be ready for the opening of navigation in the spring of 1918.

Brockville, Ont.—A scow owned by the Leslie Wrecking Co. of Kingston, with hoisting apparatus and other machinery, engaged in raising the steamer Keystorm, broke away from its fastenings in a gale early in the morning of October 14, and drifting across the river, brought up against Princess Island and sank in thirty feet of water.

The G. A. Graham Wrecked.—The steel freighter G. A. Graham, owned by the Montreal Transit Co., was driven out of her course while crossing Lake Huron recently and drifted ashore at South Bay, close to Manitoulin Island. She is believed to be a total constructive loss. The G. A. Graham was built in 1891. She is 310 feet long, has a beam of 39 feet, and is of 2,409 gross tons.

Barge Crashes Into Dock.—The gravel barge Whale, the largest operating out of Sarnia, loaded with 1,200 yards of gravel and sand, crashed into the docks at Port Huron on October 12, and tore away 60 feet of concrete wall before it stopped. The barge was stove in below the water line, and had to be partly unloaded to prevent her sinking. The accident was caused by the failure of the boat to answer her helm.

Bridgeburg, Ont. — The shipbuilding plant on the Niagara River at Bridgeburg is to be placed in operation at once by the Canadian Allis-Chalmers Co. All-steel ships of Welland Canal size will be built. The shipyard was established in 1903 by the now defunct Canadian Shipbuilding Co. The E. B. Osler, now carrying grain between Fort William and Port Colborne, was the only ship built. Some of the shipbuilding machinery has been sold, but the cranes and some mis-

cellaneous machines are still at the plant. C. W. Smith is resident manager.

Sarnia, Ont.—A contract has been let to the Gibb Dock Co. for the construction of a new ferry slip here for the Pere Marquette ferries. The work will start at once.

Steamer Richard W. Released.—The steamer Richard W., coal-laden, for Montreal, which ran ashore on Wolfe Island, in the American channel, on October 12, during the gale, has been released by the Donnelly Wrecking Co., Kingston, Ont. The boat, which is owned by the Canada Import Co. of Montreal, had her shoe fractured. Her cargo had to be removed.

Vancouver, B.C.—The Coughlan Shipyards, at which six big steel steamers will be constructed and at which four are already under construction, will also build the boilers for the vessels and a permit has been taken out for the construction of a boiler shop. The work done will be on a big scale as the steamers are to be 425 feet long and each will have a deadweight carrying capacity of 8800 tons.

Captain Wm. Sparling, of the Reid wrecking steamer Manistique, who was injured when a boom broke while the boat was working on the sunken steamer Graham, is reported to be in a serious condition at the Alpena Hospital. Captain Sparling, it was thought at first, was not badly injured, but later reports received here tell of his serious condition. He is very well known on the Great Lakes.

Launching At Kingston.—The launching of the first of two Fishery Protection Vessels was successfully accomplished at the Kingston Shipbuilding Co. yards at Kingston, Ont., on Sept. 27. The christening ceremony was performed by Mrs. H. C. Walsh, manager of the company. The vessel will be known as the Loos. Length between perpendiculars is 130 feet; breadth, moulded, 25 feet; depth, moulded, 14 feet 3 in. The sister ship, which will be known as the Thiepval, will be launched in a few weeks. Both are being built to Lloyds' specifications for ocean service.

Government Takes Over Repair Outfit.—The Federal Government has taken over the ship repair equipment of the Lake Shipbuilding Co., Buffalo, to be used in Montreal in rejoining lake vessels that have been cut in two for the trip through the Welland Canal. John Smith, marine surveyor of Cleveland, has been engaged to supervise the work. The repair outfit comprises two work scows equipped with air compressors, electric welders, bolt and pipe machines, acetylene cutting apparatus and other tools.

Sailing Ships Barred.—American sailing vessels on October 10 were forbidden by the Shipping Board to sail for the war zone. A request of French Government representatives that several ships already loaded be permitted to clear was denied, and all such craft were directed to discharge their cargoes for transfer to steamers soon to be commandeered. The Exports Council recently decided to issue no further licenses for shipments to the war zone on sailing vessels, and the War Risk Insurance Bureau for a long time has denied insurance to such ships.

Near Record Cargo. — The steamer William P. Snyder, Jr., owned by the Shenango Steamship & Transportation Co. of Cleveland, cleared from Fort William on October 21 with 484,500 bushels of No. 1 wheat. The vessel, with her nearly record cargo, was bound for Buffalo. The steamer W. Grant Morden of the Canada Steamship Lines, which left Fort William on July 17, 1916, with 491,000 bushels of wheat for Buffalo, holds the grain cargo record on the lakes.

Fishing Protection Vessels Launched.—Two vessels for the Fishery Protection Service were launched at Collingwood on Oct. 1, having been built by the Collingwood Shipbuilding Co. to the order of the Naval Service Department, of which Capt. J. W. Norcross is the director of ship construction. The vessels have the following dimensions: Length, b.p., 125 feet; length over all, 135 feet; breadth, 23 feet 6 in.; depth, 13 feet 6 in. Triple-expansion engines, 12½, 21½ and 35 in. by 24-inch stroke, steam being supplied by one boiler 13 feet 6 in. diameter by 10 feet 6 in. long, working at 180 lbs. pressure. Accommodation is provided for a crew of 17 men.

Launch At Collingwood.—The Collingwood Shipbuilding Co., on October 18, successfully launched without any formalities the oil tank steamer Talaralite, which it has built for the International Petroleum Co. of Toronto. This vessel is intended for ocean service exclusively, and is of the following dimensions: Length, 250 feet; breadth, 43 feet 9 in.; depth, 25 feet, moulded. The oil pumping arrangement is of the most efficient design to handle the cargo in the most expeditious manner. This makes the fifth oil tank steamer built by the Collingwood Shipbuilding Co. for the same owners.

Lakes Shipping Losses.—G. W. Stark, writing in the Outlook, finds that the Great Lakes are peculiarly rich in records of shipwreck. He says: "It is interesting to note that no similar area of any ocean, if suddenly stripped of its volume of water, would expose to human gaze a larger number of sunken ships or more valuable cargoes than lie at the bottom of these inland waters. A record kept between the years 1878 and 1898 reveals the startling fact that in that period 5,999 ships were wrecked on the Great Lakes, and 1,093 of these were total losses. The loss of cargo during the score of years was nearly $8,000,000.

Hudson Bay Terminals Progress.—Work at Port Nelson, on the Hudson Bay terminals, has closed for the season, and Foreman George H. Roy, of Ottawa, and a party of seventy men arrived at Halifax on October 3 on the Dominion Government steamer Sheba. Mr. Roy brings photographs showing the progress of the work during the past season. The great iron bridge extends over the sand beach and low-tide waters for a distance of half a mile, and at its extremity an island is being built up upon which the grain elevators will be erected. Work has commenced on the docks at the island. During the summer there have been no supplies coming in on account of the shortage of tonnage and labor, so it is quite certain that there cannot be much progress made next summer.

Victoria, B.C.—For the housing and assembling of marine engine parts, a contract has been let to Grant, Smith & Co. and McDonnell, Ltd., for the construction on Pier 2 of the new ocean docks, at Ogden Point, of a shed which will use up 2,000,000 feet of lumber in building. The structure will be 703 feet in length by 200 feet in width. Henry A. Bayfield, former superintendent of Dominion dredges, has been appointed by the local representatives of the Imperial Munitions Board to take full charge of the plant.

The Eastern Salvage & Lightering Co. has been incorporated under the laws of the Province of New Brunswick, with a capital of $100,000, and head office in Fairweather Building, St. John, N.B. The president and treasurer is S. M. Beatteay for 10 years connected with the Bank of New Brunswick, and latterly branch manager following the amalgamation with the Bank of Nova Scotia. C. W. Ruddock, vice-president, was also branch manager with the Banks of New Brunswick and Nova Scotia. B. E. Gallagher, general manager, and E. C. Howard, secretary, both bring to the enterprise the special business and practical experience necessary to the successful operation of the Company's enterprise.

Will Build Concrete Ships At Dundee.—Plans are well advanced for the construction of concrete ships at Dundee, Scotland, according to information received in a despatch from H. Albert Johnson, the American Consul at that port. The despatch says that the Dundee harbor trust has been informed by the Caledon Shipbuilding Co. that it has accepted the offer of the harbor trust of a building site for the construction of the concrete ships. The site is to include approximately fourteen acres, and will be put in condition by the harbor trust immediately for the commencement of work on the building of the shipyard by the Caledon Co.

Ships for Ocean Service.—The first of the Canada Steamship Lines' boats, the H. M. Pellatt, which have been taken over jointly by the Canadian and Imperial Governments, has reached Montreal and will be put in service shortly. The work of overhauling and refitting the boat was completed in Kingston during the month. The vessel has been considerably strengthened for the more exacting work that is required in ocean traffic. The steamer A. E. Ames is now being fitted in Kingston and the steamer

"Beaverton" is in dry dock at Buffalo and should be completed very shortly. The work is being rushed and when these boats have cleared their places will be taken by the Calgarian and the Hamiltonian.

Cornwall, Ont. — The steamer St. Laurent, owned by the Montreal & Cornwall Navigation Co., was burned to the water's edge while lying moored in the Cornwall Canal, opposite Central Park, shortly after six o'clock on the evening of October 19. Everything appeared to be all right when the watchman left the boat at 5.30 to go to his evening meal. The boat was purchased less than two years ago from J. T. Lamarre, of Montreal, and was on the run between Montreal and Cornwall, doing a freight-carrying trade. Owing to scarcity of help, the boat had to be taken off the route this summer. Over $8,000 in repairs was put on the boat since being tied up. The loss is estimated at $15,000, with $5,000 insurance. A dredge, owned by Mr. Cohen, of Montreal, moored at the stern of the St. Laurent, was also badly damaged.

Transfer Lake Vessels to Ocean. — In order to meet the great demand for steamers to handle the traffic between Canada, the United States and British and European ports, the Department of Marine and Fisheries is collaborating with the United States Shipping Board in transferring boats formerly plying on the Great Lakes to the overseas routes. A representative of the U. S. Shipping Board has been in conference with officials of the department at which arrangements were made for the transfer of a number of U. S. steamers now on the Great Lakes to the Atlantic service. These vessels, when too large to pass through the canals, will be cut in two. Some will be docked at the Canadian Vickers plant at Montreal, and others at the Marine Department shipyard at Sorel, where they will be put together again for the trip around to an Atlantic port. The Marine Department has for a considerable time been making arrangements whereby a number of boats on the Great Lakes will be put on the Atlantic routes before the close of lake navigation.

U.S. Lights and Fog Signals Removal. —Dates for discontinuance of the season of lights and fog signals on Lake Michigan, Green Bay and Straits of Mackinac are announced as follows:—At sunrise the morning of December 10, lights and fog signals will end service at St. Helena light station, White Shoal light station, Isle aux Galets light station, South Fox Island light station, North Manitou light station, St. Martin Island light station, and Squaw Island light station. Service will be discontinued at sunrise morning of December 20 at Beaver Island light station, and at Pottawatomie light station. All coast lights and fog signals on east side of Lake Michigan, north of North Manitou Island, and all coast lights and fog signals on west side of Lake Michigan and Green Bay, north of Cana Island, will be discontinued for the winter at close of navigation, except Pilot Island light station, Plum Island range light station, Poverty Island list station, and Seul Croix Pointe light station.

To Speed Up Shipbuilding.—With a view to speeding up the U.S. Government's great steel shipbuilding programme, now admittedly about 20 ships behind schedule, Rear Admiral Capps, general manager of the Emergency Fleet Corporation, has called upon every steel shipbuilder on the Atlantic coast to meet in Washington on October 29, with representatives of the Fleet Corporation, the Department of Labor, the American Federation of Labor and the Navy Department. The principal question to be discussed is that of labor, and an effort will be made to outline some plan to attract men to the shipyards, which need about 300,000 more operatives to carry through the work undertaken and projected.

GAMBLING IN SHIPS

WILD gambling in small coasting vessels which do not come under the Government's requisitioning scheme has been a feature of business at all South Wales shipping centres during the past few months. Ships are being sold and resold many times over, their apparent value doubling and trebling, and many men who are taking part in the game are amassing substantial fortunes.

Typical cases of these profits were quoted by a shipbroker to a "Daily Express" representative recently. A vessel was driven ashore on the Irish coast, and was sold for $450. When the coal was taken out, the buyer found there was practically nothing the matter with the ship. He sold her for $1,500, making the handsome profit of $1.050 on the deal, besides having the value of the coal. The vessel was resold for $4,000, and was eventually purchased for $7,500 and brought to South Wales. She is again offered for sale. All this happened within a month. A ship worth $2,500 changed hands so many times that the final purchaser paid $10,000 for her. She is again up for sale to the highest bidder. The owner of a vessel of 150 tons deadweight cargo was offered $5,500, but refused to sell at this figure, and he is now offered $10,000. There is reason to believe that a sale will be effected shortly at $10,500.

U.S. SHIPPING REQUISITION PLAN

ANNOUNCEMENT of the general method by which the American merchant marine is to be requistioned by the Government was made on October 14 by Bailbridge Comby of the Shipping Board in a notice sent to shipowners.

The requisition will include at first only cargo ships of more than 2,500 tons, freighters and passenger vessels of more than 2,500 gross tons register. The limit probably will be lowered soon to include craft of more than 1,500 tons.

Text of Notification

"The U.S. Shipping Board hereby gives notice to all owners of ships registered and enrolled under the laws of the United States that the requisition of all American steamers described below and of which previous announcement has been made, will become operative and effective on Oct. 15, 1917, at noon.

"1—The ships affected by said requisition and included therein are: (a) All cargo ships able to carry not less than 2,500 tons total deadweight, including bunkers, water and stores; (b) All passenger steamers of not less than 2,500 tons gross register.

"2—As to all steamers in or bound to American ports on October 15, 1917, requisition becomes effective after discharge of inward cargo and ship is put in ordinary good condition.

"B—As to steamers which have started to load their outward cargo, requisition becoming effective at noon on October 15, 1917, and accounts as to hire and expenses will be adjusted from time steamer begins to load.

"3—Steamers trading to and from American ports that have sailed on their voyage prior to October 15, at noon, are to complete their voyage as promptly as possible and report for requisitioning.

"4—Steamers that are occupied in trades between foreign ports shall be requisitioned as of October 15, at noon, and accounts adjusted accordingly.

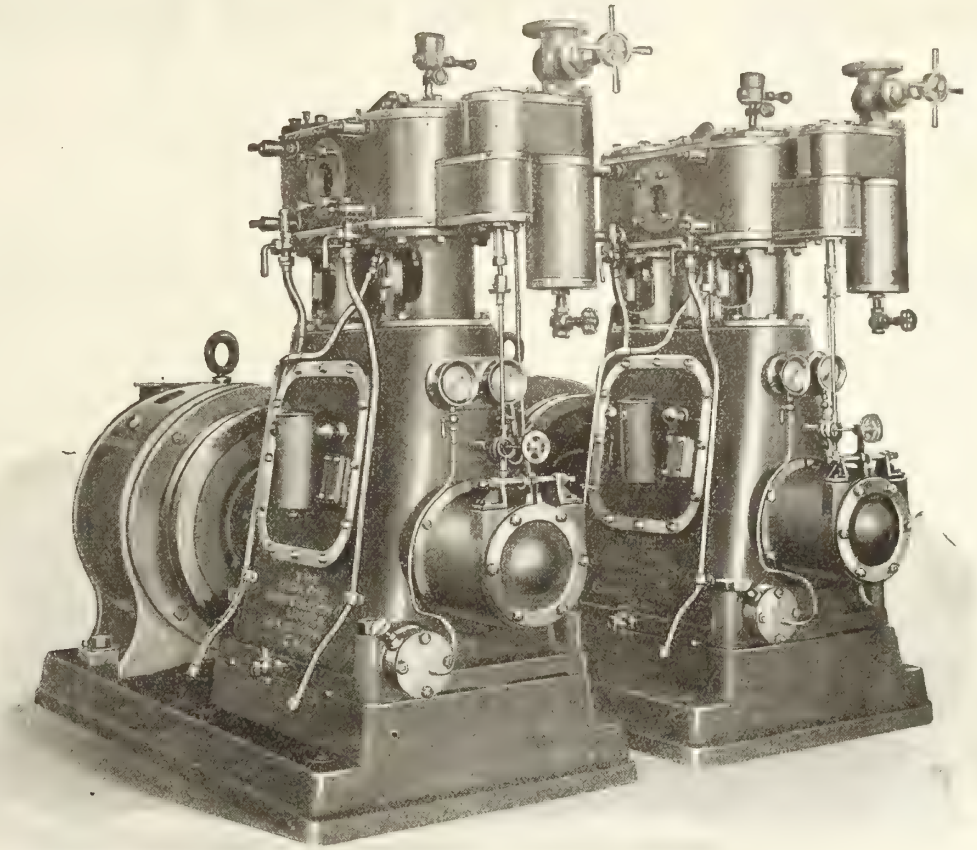
"5—Owners whose steamers are operating in their regular trades are to continue the operation of their steamers for account of the Government as they have been doing for themselves, until they receive further instructions."

CATALOGUES

Reducing Valves.—Bulletin issued by Chaplin-Fulton Mfg. Co., Pittsburg, Pa., describes the "Fulton" steam reducing valve, and also gives directions for setting and operating this device. Two types are illustrated together with prices for the various sizes.

Knudsen Packless Joints.—Bulletin issued by the Universal Valve Co., Burlington, Vt., describes the Knudsen packless swivel joint for iron pipe in steam, gas air or ammonia lines. The advantages claimed for this joint and details of its construction are dealt with fully, while a number of views are included showing applications under various conditions.

The Crane Packing Co., Chicago, manufacturers of the well known "John Crane" flexible metallic packing for all vapors and liquids, announce the establishment of their Eastern office in the Woolworth Building, New York City. Their engineer, A. W. Payne, with much experience with packing problems in the oil, mining and industrial fields, has been placed in charge of this branch.



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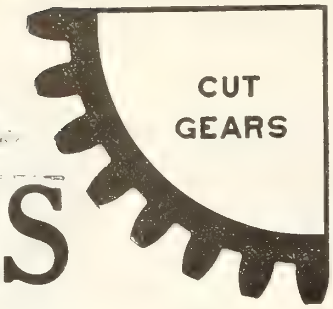

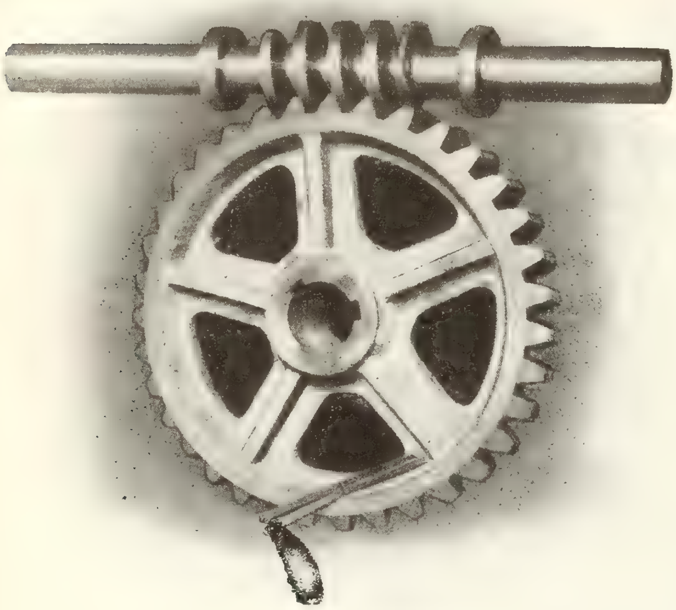

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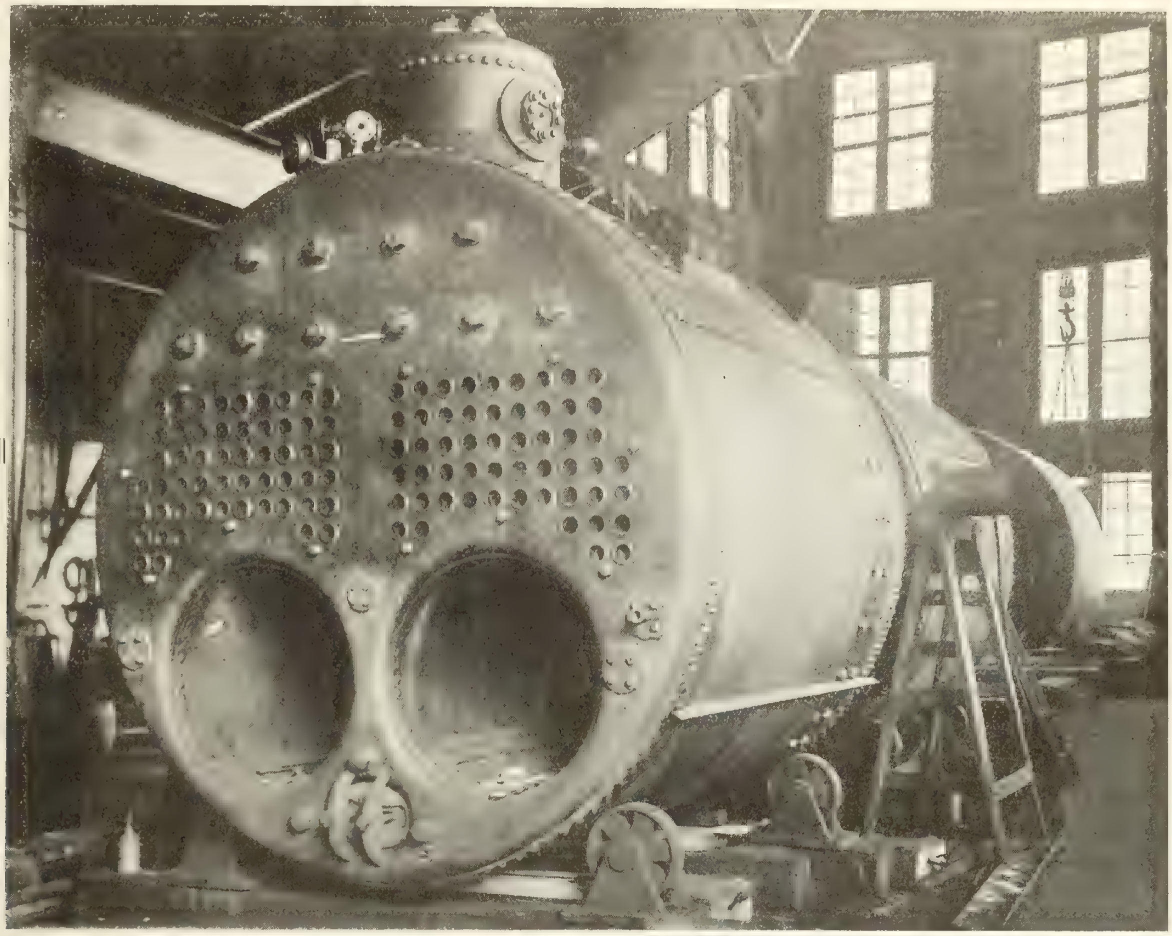

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Escaped from Germany

AN escaped prisoner tells the story of his fearful experiences in Germany in MACLEAN'S MAGAZINE for November; and gives a vivid picture of conditions in Germany as he saw them. He got out by way of Holland after appalling perils and hardships. In Holland, he was photographed, but so altered was he that his wife quite failed to recognize him in this photograph. Read this story of this Canadian soldier's escape. It is gripping stuff—a rare tale.

Canadian Finances After the War

WILL business in Canada collapse when peace comes? It may. What do the big men say? What do they know? What do you think? Are your opinions well informed? The subject is of the greatest possible importance, and you will get light and leading by reading the contribution of Col. John Bayne Maclean, who has taken the trouble to get the opinion of the biggest and most highly placed men in Canada to help him prepare his article.

Back from the Arctic

WILLIAM THOMPSON, representing the American Geographical Society, was this year in the Arctic Regions. He went to the delta of the Mackenzie River, and took many excellent pictures of the country and its Eskimo inhabitants. He makes the November MACLEAN'S the vehicle of many of his pictures and for an account of his journey. Read what this Arctic scientist has to tell us about a remote part of our land.

Slackers and Conscription

WHAT is your attitude towards the draft? You have positive opinions, of course. How do they square with Miss Laut's as they are expressed in her ringing article on Slackers in the November MACLEAN'S?

The Nation's Business

THIS is a new feature—a fearless, well-informed survey of national affairs. What we all want is an outspoken—but not vindictive—and clear-visioned presentation of factors and facts affecting our national, political and economic welfare.

Sketches of Trench Life

By Gunner McRitchie

MCRITCHIE was a cartoonist on a Western Canada daily before he went overseas. He has done a number of sketches of trench life "On the Spot," and these he has sent home, for publication in MACLEAN'S MAGAZINE. They're interesting and good.

The Late Sir Mortimer Clark

BEFORE he died, a few week ago, the late Sir Mortimer Clark, eminent jurist and an ex-Lieutenant-Governor of Ontario, wrote for MACLEAN'S an article on "Safeguarding Your Heirs." It has to do with the functions, service and safety of Trust Companies as executors of estates. This article by a man so distinguished, so cautious, so able, and so wise a counsellor, can be of first-rate value to every man perplexed with the problem of how his estate can be safely and prudently administered after he, the testator, has passed from this life.

A Complete Novelette

By Peter B. Kyne

HIS story in the November MACLEAN'S is a thunderingly good story of lumbermen and lumbering. Red blood is in this tale of business. R. M. Brinkerhoff illustrates it.

Short Story

By Ethel Watts Mumford

THE writer of this short story—the first of a delightful series by this author to appear in MACLEAN'S—is very well known among short story writers. Delicate fancy, wholesomeness, freshness and finished workmanship characterize all her work.

Short Story

By W. A. Fraser

A MIGHTILY well-written story of India—the kind that we all delight in; tense, bewildering, and lots of action. Fraser never wrote a better short story than this. Ben Ward illustrates it.

Hendryx and Oppenheim

SERIALISTS

"THE Gun Brand," by Hendryx, comes to an end in the November issue. Oppenheim's greatest story, "The Pawns Count," is continued. Oppenheim's story is the biggest single feature ever secured by MACLEAN'S.

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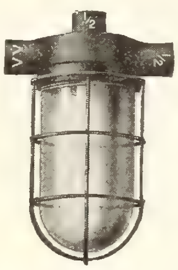

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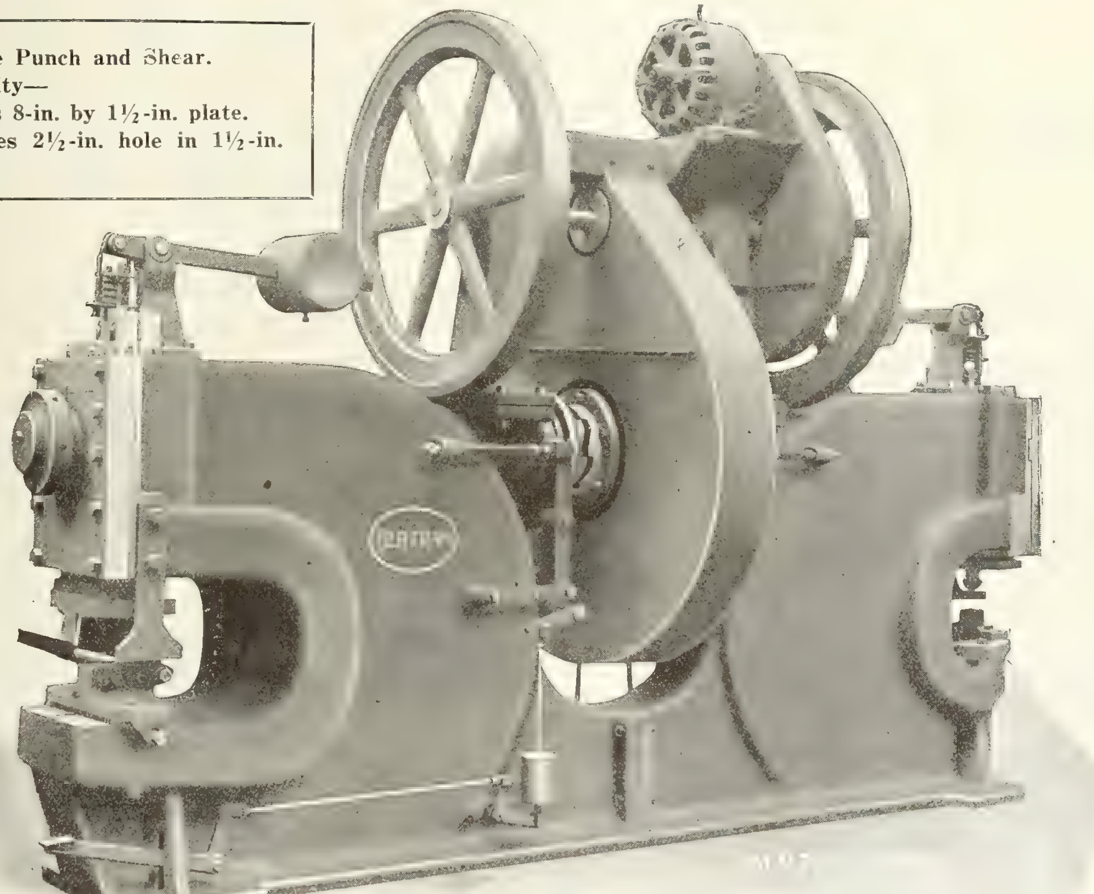
Capacity—
Shears 8-in. by 1½-in. plate.
Punches 2½-in. hole in 1½-in. plate.



The John Bertram & Sons Company Limited

DUNDAS, ONTARIO, CANADA

MONTREAL	TORONTO	VANCOUVER	WINNIPEG
723 Drummond Bldg.	1002 C.P.R. Bldg.	609 Bank of Ottawa Bldg.	1205 McArthur Bldg.

BUYERS' DIRECTORY

ALUMINUM
Canada Metal Co., Toronto, Canada

AIR WASHING EQUIPMENT
Spray Engineering Company, Boston, Mass.

ACCUMULATORS, HYDRAULIC
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

ALLOYS, BRASS AND COPPER
Dominion Copper Products Co., Ltd., Montreal, Que.

ANCHORS
Kearfott Engineering Co., New York, N.Y.
Wilson & Co., William C., Toronto, Canada.

BABBITT METAL
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.
Can. Chadwick Metal Co., Hamilton, Ontario.
Hoyt Metal Company, Toronto, Ontario.
Canada Metal Co., Toronto, Canada.
Tallman Brass & Metal Co., Hamilton, Ont.

BARGES
Can. B. K. Morton Co., Toronto, Montreal.
Polson Iron Works, Toronto, Ont.

BAROMETERS
Wilson & Co., William C., Toronto, Ont.

BARS, IRON AND STEEL
Topping Brothers, New York, N.Y.

BEARINGS, BRASS, STERN
Murray & Fraser, New Glasgow, N.S.

BELLS, SHIPS, ENGINE ROOM, ETC.
Aikenhead Hardware, Ltd., Toronto, Ont.
Cory & Son, Inc., Chas., New York, N.Y.
Morrison Brass Mfg. Co., James, Toronto, Ont.
Scythes & Co., Ltd., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

BELTING, LEATHER
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.

BIBBS, COMPRESSION
Empire Mfg. Co., London, Ont.

BINNACLES
Morrison Brass Mfg. Co., James, Toronto, Ont.
Scythes & Co., Ltd., Toronto, Ont.
Topping Brothers, New York, N.Y.

BLOCKS, CARGO, HEEL AND TACKLE
Aikenhead Hardware, Ltd., Toronto, Ontario.
Loveridge, Ltd., Docks, Cardiff, Wales.
Scythes & Co., Ltd., Toronto, Ontario.
Topping Brothers, New York, N.Y.

BLOWERS, TURBO-
Mason Regulator & Engin. Co., Montreal, Que.

BOILER FEED PUMPS
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

BOILER FITTINGS
McAvity & Sons Ltd., T., St. John, N.B.

BOILERS, MARINE
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Doxford & Sons, William, Sunderland, England.
Goldie & McCulloch, Ltd., Galt, Ont.
Hall Engineering Works, Montreal, Que.
Jenckes Machine Co., St. Catharines, Ont.
Mason Regulator & Engin. Co., Montreal, Que.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
National Shipbuilding Co., Goderich, Ont.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.
Polson Iron Works, Toronto, Ontario.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

BOOKS, TECHNICAL, MARINE
Munro & Co., Ltd., James, Glasgow, Scotland.

BOLTS
Topping Brothers, New York, N.Y.

BROKER
Fuller, Louis, N., 163 Hollis St., Halifax, N.S.
Page & Jones, Mobile, Ala., U.S.A.

BUCKETS, CLAMSHELL
Beatty & Sons, Welland, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.

BUCKETS, COALING
Beatty & Sons, Welland, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.

CABINETS, STEEL
Canada Wire & Iron Goods Co., Hamilton, nOt.

CAPSTANS
Dake Engine Co., Grand Haven, Mich.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Scythes & Co., Ltd., Toronto, Ont.

CALKING TOOLS
Topping Brothers, New York, N.Y.
Scythes & Co., Ltd., Toronto, Ont.

CALKING TOOLS, ELECTRIC
Aikenhead Hardware, Ltd., Toronto, Ont.

CALKING TOOLS, PNEUMATIC
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

CALORIFIERS
Low & Sons, Ltd., Archibald, Glasgow, Scotland

CASTINGS
Collingwood Shipbuilding Co., Collingwood, Ont.
Jenckes Machine Co., Ltd., St. Catharines, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.
The John McDougall Caledonian Iron Works Co., Montreal, Que.

CASTINGS, ALUMINUM
Tallman Brass & Metal Co., Hamilton, Ont.

CASTINGS, BRASS
Booth-Coulter Copper & Brass Co., Toronto, Ont.
Empire Mfg. Co., London, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.
McAvity & Sons Ltd., T., St. John, N.B.

CEMENT SOLUTION
Can. Bitumastic Enamels Co., Toronto, Ont.

CHAINS
Aikenhead Hardware, Ltd., Toronto, Ont.
Kearfott Engineering Co., New York, N.Y.
Topping Brothers, New York, N.Y.
Wilson & Co., William C., Toronto, Ontario.

CHANDLERY, SHIP
Leckie, Ltd., John, Toronto, Ont.

CLAMPS
Topping Brothers, New York, N.Y.

CLOCKS
American Steam Gauge & Valve Mfg. Co. Boston, Mass.
Morrison Brass Mfg. Co., James, Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

COAL
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

COCKS, BILGE, DISCHARGE, INDICATOR, ETC.
McAvity & Sons Ltd., T., St. John, N.B
Morrison Brass Mfg. Co., James, Toronto, Ont.

COCKS, BASIN
Empire Mfg. Co., London, Ont.

COMPASSES
Scythes & Co., Ltd., Toronto, Ont.
Wilson & Co., William C., Toronto, Ont.

COMPRESSORS, AIR
Can. Fairbanks-Morse Co., Montreal, Que.
Canadian Ingersoll-Rand Co., Sherbrooke, Que.
Jenckes Machine Co., St. Catharines, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

CONCRETE MIXERS
St. Clair Bros., Galt, Ontario.
The John McDougall Caledonian Iron Works Co., Montreal, Que.

CONDENSERS
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kearfott Engineering Co., New York, N.Y.
Morris Machine Works, Baldwinsville, N.Y.
Smart-Turner Mach. Co., Hamilton, Ont.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

COPING MACHINES
Bertram & Sons, Ltd., John, Dundas, Ont.

COPPERSMITHS
Booth-Coulter Copper & Brass Co., Toronto, Ont.

COPPER TUBES, SHEETS AND RODS
Dominion Copper Products Co., Ltd., Montreal, Que.

COVERS, CANVAS, FOR HATCHES, LIFE-BOATS, ETC.
Leckie, Ltd., John, Toronto, Ont.
Scythes & Co., Ltd., Toronto, Ont.

COTTON, CALKING
Wilson & Co., William C., Toronto, Ont.

COUNTERS, REVOLUTION
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

CRANES
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Herbert Morris Crane & Hoist Co., Niagara Falls, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

CRANES, ELECTRIC
Herbert Morris Crane & Hoist Co., Niagara Falls, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.

CRANES, GANTRY
Smart-Turner Mach. Co., Hamilton, Ont.

DERRICKS
Aikenhead Hardware, Ltd., Toronto, Ont.
Dake Engine Co., Grand Haven, Mich.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.

DISTILLERS
Kearfott Engineering Co., New York, N.Y.

DREDGES
Collingwood Shipbuilding Co., Collingwood, Ont.
Norbom Engineering Co., Philadelphia, Pa.
Polson Iron Works, Toronto.

DRILLS, AIR
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

DRILLS, TWIST
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

DECK PLUGS
Nashua Spool & Bobbin Co., Boston, Mass.

DRILLS, ELECTRIC
Aikenhead Hardware, Ltd., Toronto, Ont.

DRY DOCKS
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Doxford & Sons, William, Sunderland, England.
Georgian Bay Shipbuilding & Wrecking Co., Midland, Ont.
Montreal Dry Docks & Shipbuilding Co., Montreal
Muir Bros. Dry Dock Co., Port Dalhousie, Ont.
National Shipbuilding Co., Goderich, Ont.
Polson Iron Works, Toronto, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.
Yarrow, Limited, Victoria, B.C.

EJECTORS
Morrison Brass Mfg. Co., James, Toronto, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.

ELEVATING MACHINERY
Goldie & McCulloch, Ltd., Galt, Ont.
Herbert Morris Crane & Hoist Co., Niagara Falls, Ont.

ENAMEL
Can. Bitumastic Enamels Co., Toronto, Ont.

ENGINES, HOISTING
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

ENGINE, INTERNAL COMBUSTION
Doxford & Sons, William, Sunderland, England.

ENGINES, MARINE
Bolinder Co., New York, N.Y.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Vickers, Ltd., Montreal, Que.
Doxford & Sons, William, Sunderland, England.
Goldie & McCulloch, Ltd., Galt, Ont.
Iron Works, Ltd., Owen Sound, Ont.
Mason Regulator & Engin. Co., Montreal, Que.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
Murray & Fraser, New Glasgow, N.S.
National Shipbuilding Co., Goderich, Ont.
Norbom Engineering Co., Philadelphia, Pa.
Polson Iron Works, Toronto, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Trout Co., H. G., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

ENGINES, OIL
Douglas-Milligan Co., Montreal, Que.

ENGINES, STEERING
Dake Engine Co., Grand Haven, Mich.
Hamilton Gear & Machine Co., Toronto, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

EVAPORATORS
Kearfott Engineering Co., New York, N.Y.
Mason Regulator & Engin. Co., Montreal, Que.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.

EXTRACTORS, GREASE
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

FANS
Aikenhead Hardware, Ltd., Toronto, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

FENDERS, ROPE
Leckie, Ltd., John, Toronto, Ont.
Wilson & Co., William C., Toronto, Ont.

FERRULES, CONDENSER
Booth-Coulter Copper & Brass Co., Toronto, Ont.

FERRO-MANGANESE
Mitchells, Ltd., Glasgow, Scotland.

FILES
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

FIRE BRICKS
Mitchells, Ltd., Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

FILTERS, FEED WATER
Mason Regulator & Engin. Co., Montreal, Que.

FITTINGS, MOTOR BOAT
Murray & Fraser, New Glasgow, N.S.

FIXTURES, ELECTRIC
Cory & Son, Inc., Chas., New York, N.Y.
Tallman Brass & Metal Co., Hamilton, Ont.
Factory Products, Ltd., Toronto, Ont.

FORGES
Aikenhead Hardware, Ltd., Toronto, Ont.

FLAGS
Scythes & Co., Ltd., Toronto, Ont.

FLUORSPAR
Mitchells, Ltd., Glasgow, Scotland.

FORGINGS, ALL KINDS
Aikenhead Hardware, Ltd., Toronto, Ont.
Canada Foundries & Forgings, Ltd., Welland, Ont.
Collingwood Shipbuilding Co., Collingwood, Ont.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.
St. Clair Bros., Galt, Ont.

GALLEY EQUIPMENT
Wilson & Co., William C., Toronto, Ont.

GAUGES, RECORDING
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

GAUGES, WATER, PRESSURE, COMPOUND AND VACUUM
Aikenhead Hardware, Ltd., Toronto, Ont.
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.

GEARS, CUT
Hamilton Gear & Machine Co., Toronto, Ont.

GLASS
Sanderson, Pearcy & Co., Toronto, Ont.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co. Sherbrooke, Que.

HAMMERS, DROP AND BELT DRIVEN
Beaudry & Co., Boston, Mass.

HAMMERS, MOTOR DRIVEN
Beaudry & Co., Boston, Mass.

HAMMERS, NAIL MACHINE
Beaudry & Co., Boston, Mass.
United Hammer Co., Boston, Mass.

HAMMERS, POWER
United Hammer Co., Boston, Mass.

HAMMERS, RAW HIDE
Greene, Tweed & Co., New York, N.Y.

HEATING EQUIPMENT
Low & Sons, Ltd., Archibald, Glasgow, Scotland

HEATERS, FEED, WATER
Kearfott Engineering Co., New York, N.Y.
Mason Regulator & Engin. Co., Montreal, Que.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.

HOISTS, ASH
Beatty & Sons, Welland, Ont.
St. Clair Bros., Galt, Ont.

HOISTS, CHAIN
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Dake Engine Co., Grand Haven, Mich.
Herbert Morris Crane & Hoist Co., Niagara Falls, Ont.
Topping Brothers, New York, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

HOISTS, CARGO, MOVING, ETC.
Dake Engine Co., Grand Haven, Mich.
Jenckes Mach. Co., Ltd., Sherbrooke, Que.

HOISTING MACHINERY
Beatty & Sons, Welland, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.
Herbert Morris Crane & Hoist Co., Niagara Falls, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

HYDRAULIC MACHINERY
The John McDougall Caledonian Iron Works Co., Montreal, Que.

INDICATORS, ENGINE
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Cory & Son, Inc., Chas., New York, N.Y.

INDICATORS, SPEED
Aikenhead Hardware, Ltd., Toronto, Ont.
Cory & Son, Inc., Chas., New York, N.Y.
Greene, Tweed & Co., New York, N.Y.

INJECTORS
Aikenhead Hardware, Ltd., Toronto, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

INSTRUMENTS, NAUTICAL
Leckie, Ltd., John, Toronto, Ont.
Scythes & Co., Ltd., Toronto, Ont.

JOINTS, BALL SLIP
Norbom Engineering Co., Philadelphia, Pa.

INSURANCE, MARINE
Toronto Insurance & Vessel Agency, Toronto, Ont.

LATHES
Foss & Hill Machinery Co., Montreal, Que.
Bertram & Sons, Ltd., John, Dundas, Ont.

LIFEBUOYS, BELTS AND PRESERVERS
Fosbery Co., Barking, Essex, Eng.
Scythes & Co., Ltd., Toronto, Ont.

LIFE BOAT EQUIPMENT
Leckie, Ltd., John, Toronto, Ont.

LIFE JACKETS
Leckie, Ltd., John, Toronto, Ont.

LIGHTS, ALL KINDS
Can. Fairbanks-Morse Co., Montreal, Que.
Morrison Brass Mfg. Co., James, Toronto, Ont.

LIGHTS, SIDE, PORT
McAvity & Sons Ltd., T., St. John, N.B.

LIGHTING SETS
Can. Fairbanks-Morse Co., Montreal.
Cory & Son, Inc., Chas., New York, N.Y.
Kearfott Engineering Co., New York, N.Y.
Williams Machinery Co., A. R., Toronto, Ont
Wilson & Co., William C., Toronto, Ont.

LOCKERS, STEEL
Canada Wire & Iron Goods, Co., Hamilton, Ont.

LUBRICATORS
Empire Mfg. Co., London, Ont.
Greene, Tweed & Co., New York, N.Y.

MACHINISTS
Hyde Engineering Works, Montreal, Que.

MACHINE AND FORGE WORK
Thor Iron Works, Toronto, Ont.

METERS, FLOW
Spray Engineering Company, Boston, Mass.

MACHINE TOOLS
Foss & Hill Machinery Co., Montreal, Que.

MOTORS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ont.

NET LIFTERS
Dake Engine Co., Grand Haven, Mich.
Leckie, Ltd., John, Toronto, Ont.

NOZZLES, ALL KINDS
Spray Engineering Company, Boston, Mass.

OILS
Lowe Brothers, Ltd., Toronto, Ont.
Sanderson, Pearcy & Co., Toronto, Ont.

OIL CUPS
Murray & Fraser, New Glasgow, N.S.

OAKUM
Leckie, Ltd., John, Toronto, Ont.

OXY-ACETLYENE OUTFITS
Can. Fairbanks-Morse Co., Montreal, Que.
McAvity & Sons Ltd., T., St. John, N.B.
Williams Machinery Co., A. R., Toronto, Ont.

PAINT
Ault & Wiborg Co. of Can., Ltd., Toronto, Ont.
Can. Bitumastic Enamels, Ltd., Toronto, Ont.,
Lowe Brothers, Ltd., Toronto, Ont.
Sanderson, Pearcy & Co., Toronto, Ont.

PAINT SPRAYING EQUIPMENT
Spray Engineering Company, Boston, Mass.

PACKING, AMMONIA
Can. B. K. Morton Co., Montreal.
France Packing Co., Philadelphia, Pa.

PACKING, MARINE
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Montreal.
France Packing Co., Philadelphia, Pa.

PACKING, METALLIC
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Montreal.
France Packing Co., Philadelphia, Pa.

PACKING PISTON ROD
Greene, Tweed & Co., New York, N.Y.

PACKING, STEAM
Aikenhead Hardware, Ltd., Toronto, Ont.
France Packing Co., Philadelphia, Pa.

PINIONS, CUT
Hamilton Gear & Machine Co., Toronto, Ont.

PIPE, LAPWELD, CAST IRON, RIVETED
Norbom Engineering Co., Philadelphia, Pa.

PLANERS
Foss & Hill Machinery Co., Montreal, Que.
Bertram & Sons, Ltd., John, Dundas, Ont.

PLANERS, STANDARD AND ROTARY
Preston Woodworking Machinery Co., Preston, Ont.

PLATE PUNCH TABLES
Norbom Engineering Co., Philadelphia, Pa.

PLATE WORK
Jenckes Machine Co., St. Catharines, Ont.

PLUMBING EQUIPMENT
Low & Sons, Ltd., Archibald, Glasgow, Scotland.
Empire Mfg. Co., London, Ont.

PROPELLOR BLADES, BRONZE
Murray & Fraser, New Glasgow, N.S.
Yarrow, Limited, Victoria, B.C.

PROPELLER WHEELS
Kennedy & Sons, Wm., Owen Sound, Ont.
Trout Co., H. G., Buffalo, N.Y.

PIPING, COPPER
Booth-Coulter Copper & Brass Co., Toronto, Ont.

PITCH, PINE
Wilson & Co., William C., Toronto, Ont.

PULLEYS
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS
Can. Fairbanks-Morse Co., Montreal, Que.
Goldie & McCulloch, Ltd., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMP, AIR
Can. Ingersoll-Rand Co. Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, CIRCULATING
Kingsford Fdy. & Mach. Works, Oswego, N.Y.
Morris Machine Works, Baldwinsville, N.Y.

PUMPS, CENTRIFUGAL
Can. Ingersoll-Rand Co. Sherbrooke, Que.
Kearfott Engineering Co., New York, N.Y.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Norbom Engineering Co., Philadelphia, Pa.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMP, FEED
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, HAND AND POWER
Aikenhead Hardware, Ltd., Toronto, Ont.
Canada Foundries & Forgings, Ltd., Welland, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, HIGH PRESSURE
Canadian Ingersoll-Rand Co., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

PUMPS, TURBINE
Kingsford Fdy. & Mach. Works, Oswego, N.Y.

PUMPING MACHINES
Norbom Engineering Co., Philadelphia, Pa.

PUNCHES
Bertram & Sons, Ltd., John, Dundas, Ont.

PUNCHES, SINGLE, DOUBLE AND MULTIPLE
Norbom Engineering Co., Philadelphia, Pa.

RADIO ENGINEERS
Cutting & Washington, Inc., Cambridge, Mass.

RADIATORS, STEAM, ELECTRIC
Low & Sons, Ltd., Archibald, Glasgow, Scotland.

RAILING
Canada Wire & Iron Goods Co., Hamilton, Ont.

RECEIVERS, AIR
Can. Ingersoll-Rand Co. Sherbrooke, Que.

REGULATORS, FEED WATER
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

REGULATORS, PRESSURE
Mason Regulator & Engin. Co., Montreal, Que.

REPAIRS, MARINE
Corbet Foundry & Mach. Co., Owen Sound, Ont.
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Georgian Bay Shipbuilding & Wrecking Co., Midland, Ont.
Hyde Engineering Works, Montreal, Que.
Iron Works, Ltd., Owen Sound, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
Muir Bros. Dry Dock Co., Port Dalhousie, Ont.
National Shipbuilding Co., Goderich, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Yarrow, Limited, Victoria, B.C.

RIGGING, WIRE ROPE
Leckie, Ltd., John, Toronto, Ont.

RIVETERS, PNEUMATIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS, STRAIGHTENING, BENDING
Bertram & Sons, Ltd., John, Dundas, Ont.

ROPE BLOCKS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Thor Iron Works, Toronto, Ont.
Scythes & Co., Ltd., Toronto, Ont.

ROPE
Leckie, Ltd., John, Toronto, Ont.
Scythes & Co., Ltd., Toronto, Ont.

SAWS, BAND
Preston Woodworking Machinery Co., Preston, Ont.

SAW MILL MACHINERY
Preston Woodworking Machinery Co., Preston, Ont.

SCALES, BOILERS, ENGINES
Can. Fairbanks-Morse Co., Montreal, Que.

SCOWS
Collingwood Shipbuilding Co., Collingwood, Ont.
Polson Iron Works, Toronto, Ont.

SHAPES
Topping Brothers, New York, N.Y.

SEPARATORS, OIL, STEAM
Mason Regulator & Engin. Co., Montreal, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

SHAFTS, CRANK
Canada Foundries & Forgings, Ltd., Welland Ont.

SHAFTING, BRONZE
Murray & Fraser, New Glasgow, N.B.

SHEARS
Bertram & Sons, Ltd., John, Dundas, Ont.
Foss & Hill Machinery Co., Montreal, Que.
Norbom Engineering Co., Philadelphia, Pa.

SHIPBUILDING TOOLS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

SHIPS, BUILDERS OF
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Doxford & Sons, William, Sunderland, England.
Georgian Bay Shipbuilding & Wrecking Co., Midland, Ont.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
National Shipbuilding Co., Goderich, Ont.
Polson Iron Works, Toronto, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.
Yarrow, Limited, Victoria, B.C.

SHIP BROKERS
Page & Jones, Mobile, Ala.

SHIP PLATES
Douglas-Milligan Co., Montreal, Que.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.
Topping Brothers, New York, N.Y.

SHIPS' TELEGRAPHS
Cory & Son, Inc., Chas., New York, N.Y.
Morrison Brass Mfg. Co., James, Toronto, Ont.
Wilson & Co., William C., Toronto, Ont.

SLEDGES
Canada Foundries & Forgings, Ltd., Welland Ont.

SOUNDING MACHINES
Scythes & Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY
Smart-Turner Mach. Co., Hamilton, Ont.

SPIKES
Topping Brothers, New York, N.Y.

SPRAY COOLING EQUIPMENT
Spray Engineering Company, Boston, Mass.

STANDPIPES
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Thor Iron Works, Toronto, Ont.

STEAMSHIP AGENTS
Page & Jones, Mobile, Ala.

STEAM SPECIALTIES
Can. Fairbanks-Morse Co., Montreal, Que.

STEAM TRAPS
Aikenhead Hardware, Ltd., Toronto, Ont.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Empire Mfg. Co., London, Ont.
Foss & Hill Machinery Co., Montreal, Que.
Mason Regulator & Engin. Co., Montreal, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

STEEL, HIGH SPEED
Can. B. K. Morton Co., Toronto, Montreal.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

STERILIZERS, WATER
Northern Electric Co., Montreal, Que.

TANKS, STEEL
Jenckes Mach. Co., Ltd., Sherbrooke, Que.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.

TANKS
Corbet Foundry & Mach. Co., Owen Sound, Ont.
Goldie & McCulloch, Ltd., Galt, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.

TELEPHONES, MARINE
Cory & Son, Inc., Chas., New York, N.Y.

TREENAILS
Topping Brothers, New York, N.Y.
Nashua Spool & Bobbin Co., Boston, Mass.

TROLLEYS
Can. Fairbanks-Morse Co., Montreal, Que.

TRUCKS, HAND, ELECTRIC
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.

TUGS
Collingwood Shipbuilding Co., Collingwood, Ont.
Polson Iron Works, Toronto, Ont.

TURBINES, DIRECT-DRIVING AND GEARED
Doxford & Sons, William, Sunderland, England.

UNIONS, ALL KINDS
Dart Union Company, Toronto, Ont.

VALVES
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Can. Fairbanks-Morse Co., Montreal, Que.
Empire Mfg. Co., London, Ont.
McAvity & Sons, Ltd., T., St. John, N.B.
Mason Regulator & Engin. Co., Montreal, Que.
Norbom Engineering Co., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.

VALVES, FOOT
Aikenhead Hardware, Ltd., Toronto, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.

VALVES, STOP, REDUCING, SAFETY CHECK, ETC.
Aikenhead Hardware, Ltd., Toronto, Ont.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
McAvity & Sons Ltd., T., St. John, N.B.
Morrison Brass Mfg. Co., James, Toronto, Ont.

VARNISHES
Aikenhead Hardware, Ltd., Toronto, Ont.
Ault & Wiborg Co. of Can., Ltd., Toronto, Ont.
Sanderson, Pearcy & Co., Toronto, Ont.
Leckie, Ltd., John, Toronto, Ont.
Lowe Brothers, Ltd., Toronto, Ont.
McAvity & Sons Ltd., T., St. John, N.B.

VENTILATION EQUIPMENT
Low & Sons, Ltd., Archibald, Glasgow, Scotland

WATER COLUMNS
Morrison Brass Mfg. Co., James, Toronto, Ont.

WATER HEATERS
Morrison Brass Mfg. Co., James, Toronto, Ont.

WASTE AND WIPERS
Scythes & Co., Ltd., Toronto, Ont.

WEDGES, OAK
Nashua Spool & Bobbin Co., Boston, Mass.
Topping Brothers, New York, N.Y.

WELDING, ELECTRIC
Hall Engineering Works, Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Marine Welding Co., Buffalo, N.Y.
Beatty & Sons, Welland, Ont.

WHISTLES AND SYRENS
Morrison Brass Mfg. Co., Jas., Toronto, Ont.

WINCHES, CARGO
Aikenhead Hardware, Ltd., Toronto, Ont.
Jenckes Machine Co., St. Catharines, Ont.

WINCHES, DOCK, SHIP
Beatty & Sons, Welland, Ont.
Jenckes Machine Co., St. Catharines, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.
Wilson & Co., William C., Toronto, Ont.

WINCHES, TOWING
Corbet Foundry & Mach. Co., Owen Sound, Ont.
Jenckes Mach. Co., Ltd., Sherbrooke, Que.

WINCHES, TRAWL
Beatty & Sons, Welland, Ont.
Jenckes Mach. Co., Ltd., Sherbrooke, Que.

WINDLASSES
Dake Engine Co., Grand Haven, Mich.
Jenckes Mach. Co., Ltd., Sherbrooke, Que.
Wilson & Co., William C., Toronto, Ont.

WIPER CAPS, OILER BOXES, ETC.
Morrison Brass Mfg. Co., James, Toronto, Ont.

WIRE CLOTH
Canada Wire & Iron Goods Co., Hamilton, Ont.

WIRELESS OUTFITS
Cutting & Washington, Inc., Cambridge, Mass.

WRENCHES
Canada Foundries & Forgings, Ltd., Welland Ont.

WRENCHES, CHAIN PIPE
Greene, Tweed & Co., New York, N.Y.

WRENCHES, REVERSIBLE RATCHET
Greene, Tweed & Co., New York, N.Y.

WOOD WORKING MACHINERY
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Preston Woodworking Machinery Co., Preston, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

WOOD BORING TOOLS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.

LOW'S SPECIALITIES FOR SHIPS

We are Specialists in Appliances for

HEATING and VENTILATION
FITTINGS for PLUMBING WORK

Also all kinds of

BRASS and SHEET METAL WORK

REQUIRED IN THE CONSTRUCTION OF SHIPS.

We have supplied many well-known vessels with all their requirements in the departments referred to.

Low's Patent Steam Radiators

Strong enough to stand High-Pressure.

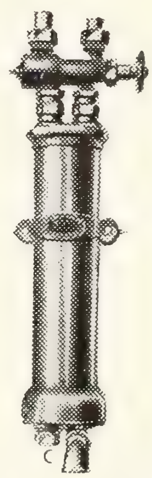
All surface in actual contact with Steam.

No Webs used to make up the surface.

Gives most heat for smallest space occupied

Internal Tubes give accelerated circulation of air.

Low's Patent Calorifiers



45 GALLONS OF HOT WATER PER MINUTE.

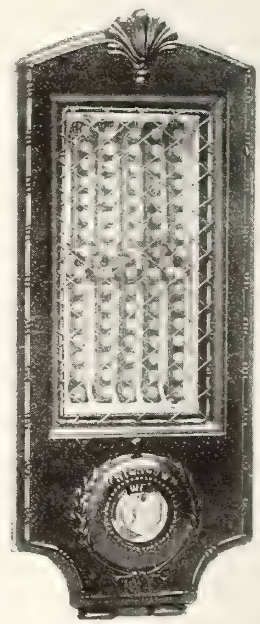
Largest output with minimum of space occupied.

PATENT VALVE PREVENTS ACCIDENTAL SCALDING.

ADOPTED BY THE ADMIRALTY.

STEAM CANNOT BE TURNED ON BEFORE THE WATER.

"Highlow" Electric Radiators



Specially designed for Ships' use.

Simple in Construction.

Guaranteed for Two Years.

No Mica or other complications to get out of order.

Large quantities of usual Ships' voltages in Stock.

ARCHIBALD LOW & SONS, LTD.

MERKLAND WORKS, PARTICK, GLASGOW

LIVERPOOL AGENTS:
A. J. Nevill & Co., 9 Cook St.

N.E. COAST AGENTS:
Ryder, Mumme & Co., Milburn House, Newcastle-on-Tyne.

LONDON OFFICE:
31 Budge Row, Cannon St., E.C.

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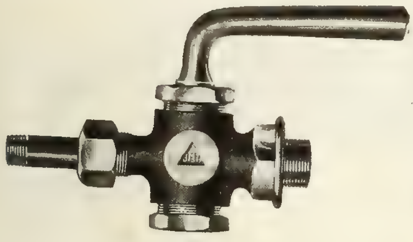
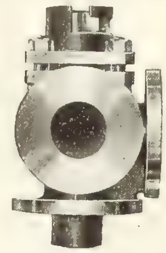
MORRISON's MARINE SPECIALTIES

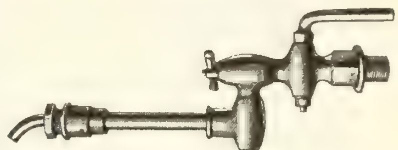


Drain Cock
Bronze. Asbestos Packed

Indicator Cock

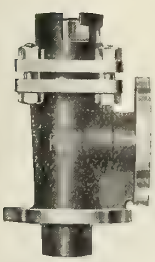


Ship's Side Cock
WithLocking Shield,Bronze



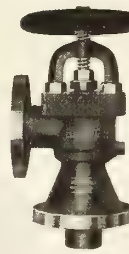
Water Service Cock
Universal Joint, Telescopic

Ship's Bell

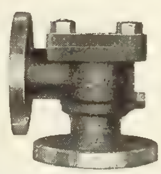


Ships' Side Cock
With Locking Shield
Bronze

Asbestos Packed Angle Cock
With Gland and Holding Down Plate.
Bronze



"Beaver" Angle Valve
Bronze. Long neck and spigot



"Beaver" Check Valve
Bronze

BEAVER VALVES

"Beaver" valves have bronze, iron or semi-steel bodies mounted with high grade bronze.

The valve and seat can be furnished metal to metal regrinding, or with renewable copper disc. The seats are renewable and are fitted with set screws to prevent them working loose when the valve is in operation.

Particular attention is called to our improved joint between the body and yoke, the machined faces of the double spigot preventing any possibility of the gasket blowing out.

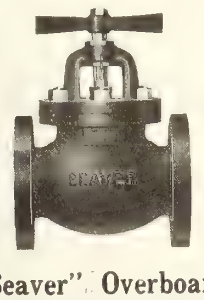
The threads on the bronze stems engage those in the bronze bushings in the top of the yokes, which is prevented from turning by being fitted between two flat faces and is held in place by lock nut on top.

The stuffing box gland being made of bronze offers a non-corrosive surface for the stem and also prevents the gland breaking when the stuffing box is being packed.

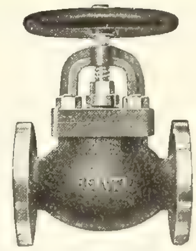
An important feature in the design of a valve is the areas through the body and seat and in this particular liberal allowance has been made in the construction of "Beaver" valves. At no point are they cramped, or will they obstruct the free flow of steam or water, the areas being in excess of the nominal diameters of the connecting pipes, yet the valves occupy a minimum of space.

"Beaver" valves are designed for a working steam pressure of 250 lbs. per sq. inch, and are subjected to a hydraulic test of 400 lbs. per sq. inch before leaving our factory.

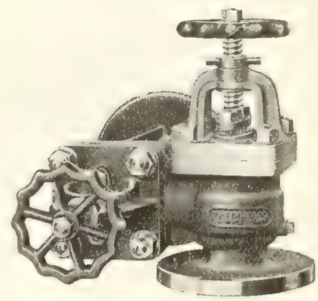
Beaver Globe Valve
Iron Body. Bronze Mounted



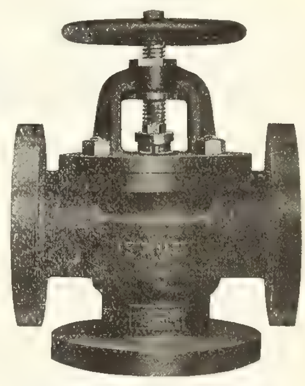
"Beaver" Overboard Discharge Valve
Iron Body. Bronze Mounted



"Beaver" Stop Valve
Bronze



"Beaver" Combined Stop and Check Valve
Bronze, Type A.



"Beaver" Cross Valve
Iron Body. Bronze Mounted

The James Morrison Brass Manufacturing Co., Limited, 89-97 Adelaide St. West, Toronto

CIRCULATES IN EVERY PROVINCE OF CANADA AND ABROAD

MARINE ENGINEERING of Canada

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World. Published by The MacLean Publishing Co., Limited

MONTREAL, Southam Building TORONTO 143-153 University Ave. WINNIPEG, 1207 Union Trust Bldg. LONDON, ENG., 88 Fleet St.

Vol. VII. Publication Office, Toronto—November 1917 No. 11

The Publisher's Page

TORONTO November, 1917

The Economy of Business Paper Advertising

By H. E. CLELAND, NEW YORK

Awarded the Higham prize at the convention of Associated Advertising Clubs, at St. Louis, June, 1917. This prize is given annually to the one delivering the most constructive address in the fewest words.

ECONOMY is a many sided question and may mean anything up to the threshold of total abstinence. But Webster tagged it best when he said it means "a judicious expenditure of money."

War is shoving economy of this kind into the spotlight, thereby proving that war is not all battles, blood and what Sherman said it was. War has its good side. It has upset a centuries-old and centuries-rotten despotism. It has whipped British manufacturing methods into a state of high efficiency. It has waked up a snoring America.

In these conditions there's room for the advertising man, whether he be publisher, agent, salesman or user, who persists in dressing advertising in garments of glittering guff. It must be stripped to its effective self; made ready to fight, not to pose.

In brief, advertising must now line up with every other business and make every dollar spent for it a "judicious expenditure of money."

The business press of the country welcomes this return to the fundamentals, for with this attitude must come a full appreciation of the effective economy of business paper advertising.

Business paper advertising has never posed. It never has been nor will be surrounded by the pomp and circumstance of enormous circulation. It cannot hope to fly the banner of tremendous rates. The average cost per page is so low that it doesn't sound respectable.

In short, business paper advertising is not the bass drum of this band. It doesn't make the noise—but it carries the tune, clear and true.

We assert for it a very high efficiency per dollar of cost. And that, we believe, is the aim—and rightfully the aim—of every straight-thinking advertising man.

THE REASONS WHY

And these are the reasons why it is effective.

First, the editorial character of each paper limits the circulation to those men in an industry or trade who are responsible for results. These are the men who actually buy or recommend the buying of the machinery or merchandise advertised in the paper. Therefore, waste circulation practically does not exist and is in every event cut to the bone. Hence, at the very beginning we strike at effective advertising's greatest extravagance, waste circulation, and put in its place intensive circulation.

Second, the buying power per subscriber represents an infinitely greater sum than the buying power per subscriber of any other class of publication because each buyer purchases for business and not private consumption.

Third, the editorial contents of the paper are in harmony with the advertising pages. The first tells a man "how" and the second shows "what with." To borrow the simile of a colleague of mine, the whole paper may be regarded as an enormous advertisement with the editorial pages carrying the educational copy and the advertising pages representing the return coupon.

In a recent investigation as to the effectiveness of advertising run next to reading matter and advertising which was segregated, it was demonstrated that when the reading matter next to the advertisement was germane to the product advertised, then results from the advertising were far and away ahead of results when the reading matter was on a subject foreign to the product advertised.

This investigation was carried on in the general field, but I regard it as one of the best arguments for business paper advertising I have ever heard. In a sense, all advertising in a business paper is "next to reading."

Those three fundamental reasons form the backbone of effective economy in advertising and sum up thus:—

THE CONCLUSIONS

Business paper advertising is economical because it reaches—and the advertiser only pays for—a circulation of tremendous buying power which is continually being taught by the publication itself to want the products advertised.

The business of the busines papers is to exert a wise and wide influence upon the commercial and industrial development of the country.

We cannot surround them with flowers and furbelows, nor is it necessary to allure the non-technical, non-trade man with pictures of Gertie Coughdrop, "the film's flossiest flapper."

Our readers are not to be caught by any cheap expedients. And those editors and advertising writers who find it necessary to mount their untamed vocabularies, jab them a couple of times with their favorite adjectives, and ride off in a ribald revel of words, have no place in the modern business publication.

Business papers are not intended to amuse, are not intended for the tired business men. They touch men—and men only—on that side of their lives which occupies most of their wakeful hours. They instruct, lead, guide and help men to do things, to build things and to sell things. They are for the world's doers when they are in the midst of doing.

In one of Mark Sullivan's editorials in Collier's he says:—

"Progress is no monopoly of the cannon makers. In one issue of the 'Electrical World' we note that the Columbus (Ohio) Railway, Power & Light Company has set out to make its buildings safer. Fire escapes, standard doors, and other improvements have been added, along with **a rigid system of inspection** to prevent the accumulation of waste and grease, so that in three years fire risks and insurance rates have been cut nearly in half. In Johnston, S.C., F. M. Boyd, manager for the Carolina Public Service Company, has devised a new type of twenty-five foot pole with a twelve-foot mast-arm sticking out on the street side so as to keep the poles lined up on the curb, but get the wires away from the beautiful old elms and water oaks that are the glory of Johnston's highways. Anyone who has seen the ruin and multilation left by fanatical tree trimmers will appreciate Mr. Boyd's device. The Ohio Electric Light Association reports that its members have saved from three to five cents per ton on all coal handled at certain of their power houses by putting in an eight-hour day for firemen. This ought to interest the old-timers who think twelve hours' toil an inalienable right for engine-room workers. Those three items cover vital subjects and are only part of the grist in one issue of a live technical journal. That's how our United States goes along."

Those of you who know Collier's know that this comment is from an authority whose point of observation is a long way from the bull pen.

(Continued next month.)

LOW'S SPECIALITIES FOR SHIPS

We are Specialists in Appliances for

HEATING and PLUMBING WORK

We also make all kinds of

BRASS and SHEET METAL WORK

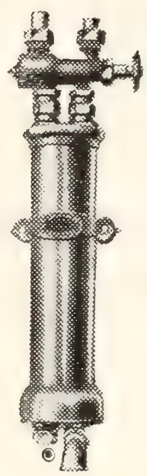
REQUIRED IN THE CONSTRUCTION OF SHIPS.

We have supplied many well-known vessels with all their requirements in the departments referred to.

Low's Patent Steam Radiators

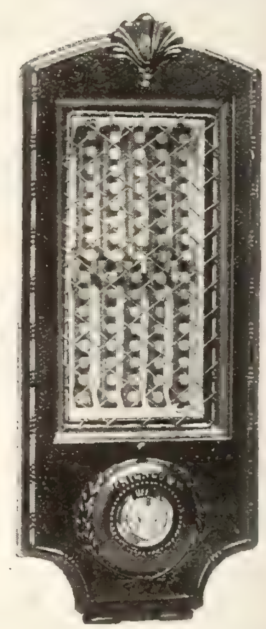
Strong enough to stand High-Pressure.
All surface in actual contact with Steam.
No Webs used to make up the surface.
Gives most heat for smallest space occupied
Internal Tubes give accelerated circulation of air.

Low's Patent Calorifiers



45 GALLONS OF HOT WATER PER MINUTE.
Largest output with minimum of space occupied.
PATENT VALVE PREVENTS ACCIDENTAL SCALDING.
ADOPTED BY THE ADMIRALTY.
STEAM CANNOT BE TURNED ON BEFORE THE WATER.

"Highlow" Electric Radiators



Specially designed for Ships' use.
Simple in Construction.
Guaranteed for Two Years.
No Mica or other complications to get out of order.
Large quantities of usual Ships' voltages in Stock.

ARCHIBALD LOW & SONS, LTD

MERKLAND WORKS, PARTICK, GLASGOW

LIVERPOOL AGENTS: A. J. Nevill & Co., 9 Cook St.

N.E. COAST AGENTS: Ryder, Mumme & Co., Milburn House, Newcastle-on-Tyne.

LONDON OFFICE: 31 Budge Row, Cannon St., .E.C

Established 1834 *Incorporated 1907*

MARINE SPECIALTIES

BRASS and IRON

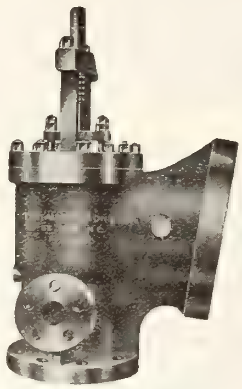
Port Lights
with and without storm doors.

Marine Valves
and Cocks, all sizes and kinds.

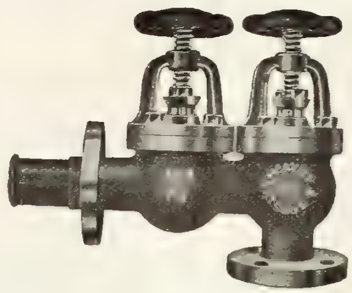
Water Columns
Asbestos Packed

Water Gauges

Gauge Cocks



Throttle Valve



Main Feed and Shut-off Valve Combined

Rudder Braces,
Dumb Braces,
Dove Tails,
Ships' Bells,
Steering Wheel Caps, Diamonds, etc.,
Ships' Pumps,
Sheaves and Bushings,
Ships' Hardware

T. McAvity & Sons, Limited

BRASS and IRON FOUNDERS

Wholesale and Retail Hardware, Marine Specialties, Etc.

ST. JOHN, N.B., Canada

Branches at MONTREAL, TORONTO, WINNIPEG, VANCOUVER, LONDON, England.

TELEGRAMS: "VICKERS, MONTREAL"
PHONE LASALLE 2490

OFFICE AND WORKS
LONGUE POINTE, MONTREAL

CANADIAN VICKERS LIMITED

SHIP, ENGINE, BOILER, and ELECTRICAL

REPAIRS

25,000-TON FLOATING DOCK, 600 FEET LONG
OPERATED IN ONE OR TWO SECTIONS

SHIP, ENGINE and BOILER BUILDERS

COMPLETE EQUIPMENT

AIR, ELECTRIC, HYDRAULIC TOOLS, ELECTRIC AND ACETYLENE WELDING,
SHIP REPAIR AND FITTING-OUT BASIN ADJOINING WORKS AND MONTREAL HARBOUR,
WITH WHARF 1000 FEET LONG. DEEP-WATER BERTH.

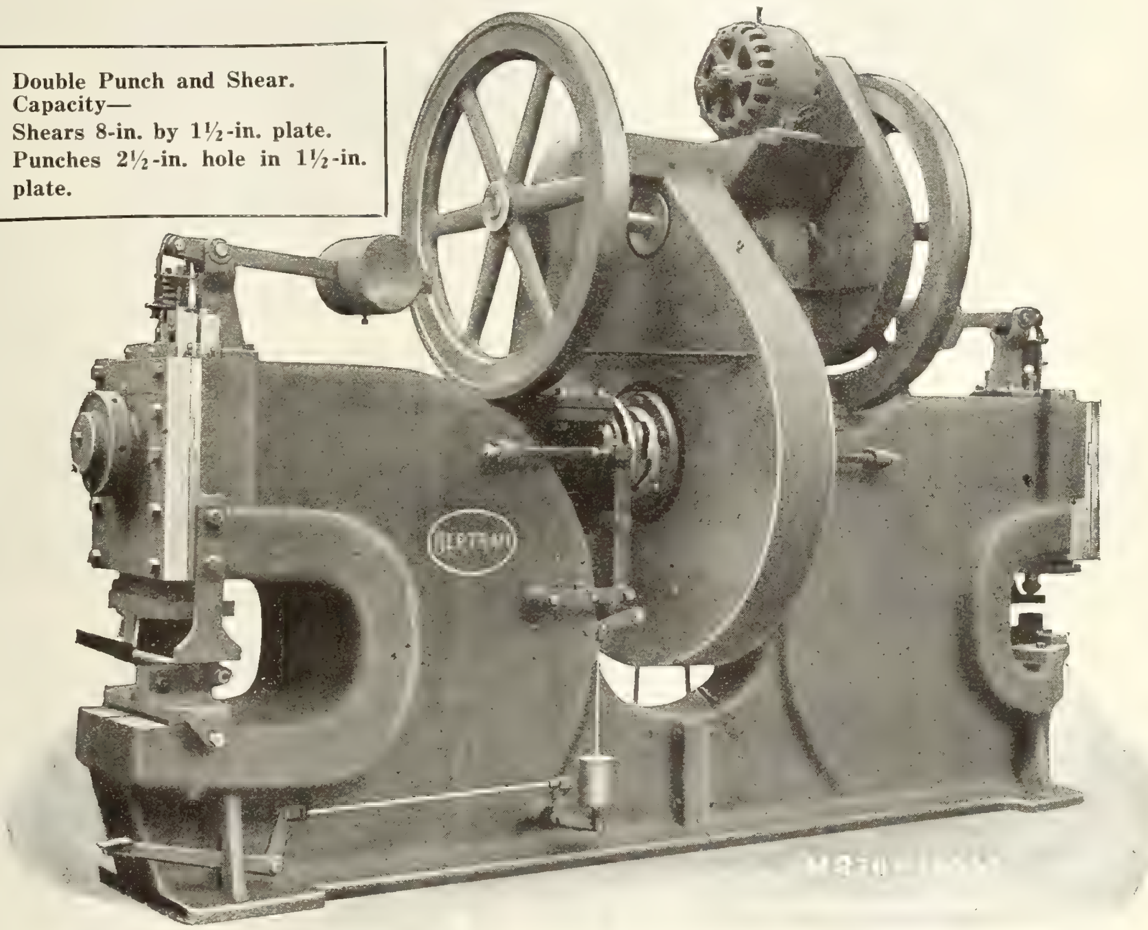
BERTRAM MACHINE TOOLS

For Structural, Bridge and Shipbuilding Plants

Modern in design and built for heavy service, our line embraces a varied equipment of Punches, Shears, Bending and Straightening Rolls, Coping Machines, Rotary and Plate Planers.

The assistance and advice of our engineers are yours for the asking.

Double Punch and Shear.
Capacity—
Shears 8-in. by 1½-in. plate.
Punches 2½-in. hole in 1½-in. plate.

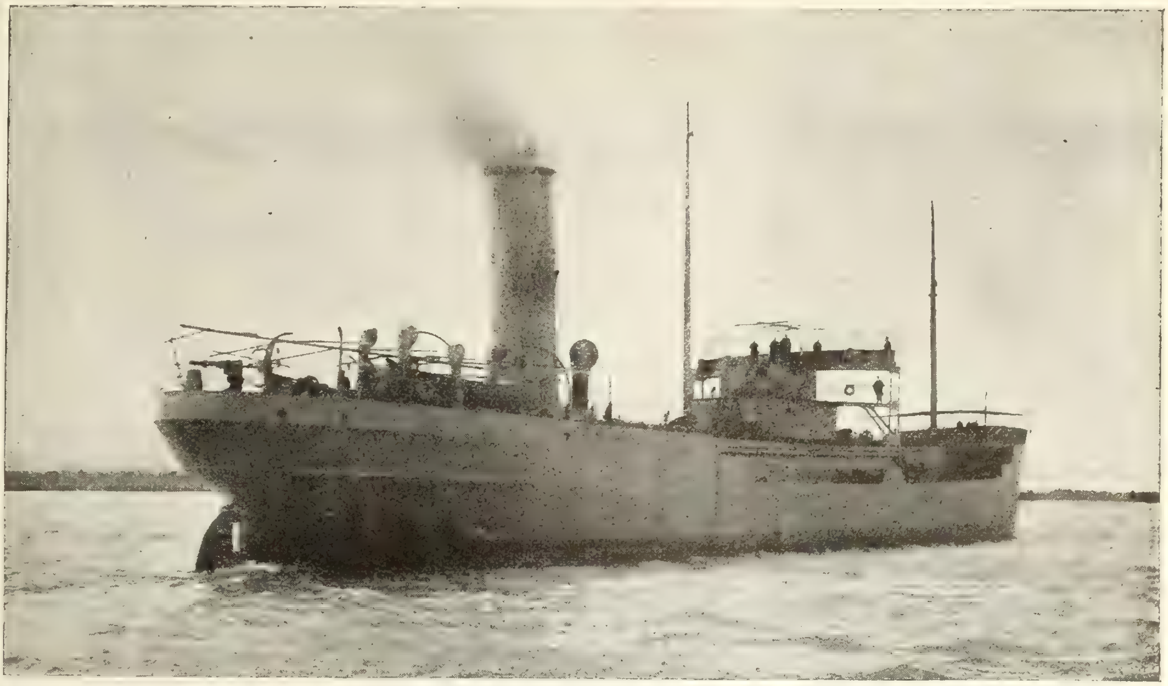


The John Bertram & Sons Company
Limited

DUNDAS, ONTARIO, CANADA

MONTREAL	TORONTO	VANCOUVER	WINNIPEG
723 Drummond Bldg.	1002 C.P.R. Bldg.	609 Bank of Ottawa Bldg.	1205 McArthur Bldg.

BUY VICTORY BONDS—SAFEST INVESTMENT IN CANADA TO-DAY.



The Imperial Oil Tanker "Reginolite" on which B-H Anti-Fouling Composition is used. Built by the Collingwood Shipbuilding Co., Collingwood, Ont.

B-H
ANTI-FOULING COMPOSITION

Our head chemist spent some time conducting a series of experiments to arrive at the correct formula for an anti-fouling composition. These experiments were made at Bombay, on the Indian Ocean—the worst ocean in the world for fouling ships' bottoms. After many tests, he secured the most satisfactory formula and this is the formula used in B-H Anchor Anti-Fouling Composition.

You are sure of satisfaction in using our Anti-Corrosive and Anti-Fouling Compositions.

Among the varieties of Marine Paints we manufacture are:—

Hull Paints
Deck Paints
Marine Zinc White
Cabin Enamels
Copper Paints
White Lead
Anti-Corrosive Composition
Anti-Fouling Composition
Lower Hold Composition
Engine Enamels
Aluminum Paints
Red Lead

Color Cards and Full Information on Request.

BRANDRAM-HENDERSON LIMITED
MONTREAL HALIFAX ST JOHN TORONTO WINNIPEG CALGARY EDMONTON VANCOUVER

Launching of the 200-Ton Ferro-Concrete Barge "Beton I."

By C. T. R.

The abnormal shortage of ocean-going steel freighters due to German submarine activity, combined with the difficulty of prompt replacement through the greater part of our steel mill output being diverted to the manufacture of shell and kindred munitions of war, has directed attention to ferro-concrete ship construction, because of the greater rapidity with which fabrication can be accomplished. Although little beyond the barge type of vessel has as yet materialized, there is little doubt that, with the experience being steadily accumulated, something more akin to ocean craft may be expected to take the water in the near future.

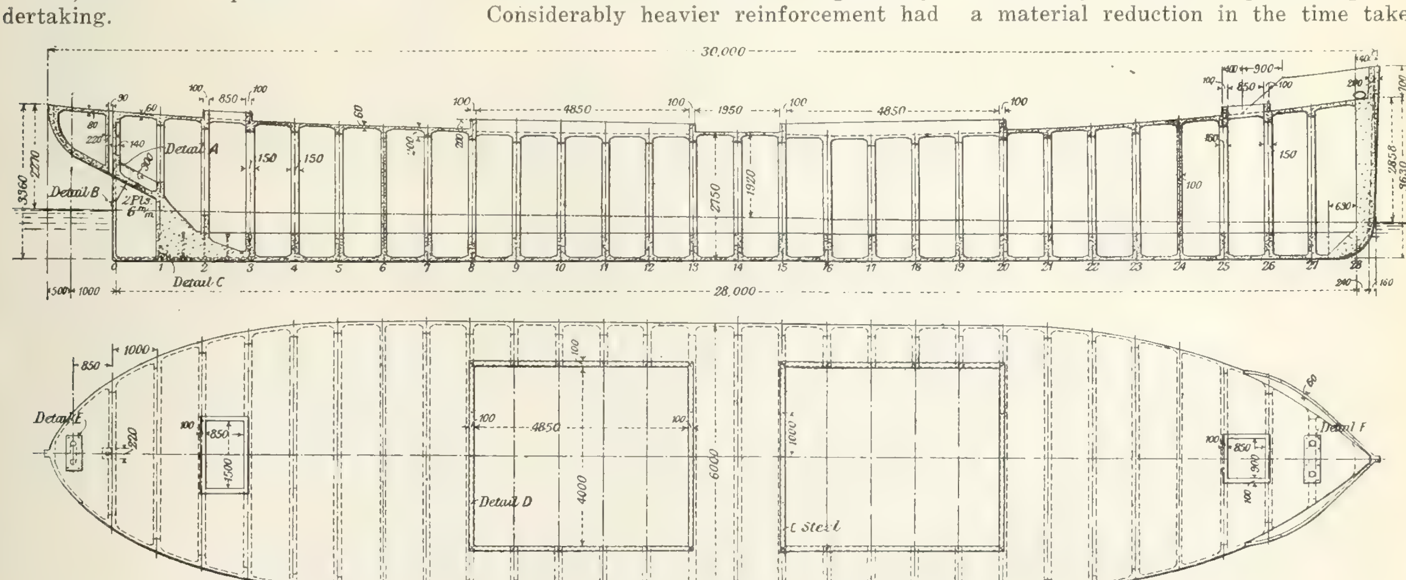
IT is now generally conceded that vessels of ferro-concrete construction, although never likely to become serious competitors of those of steel in normal times, will find a large sphere of service as lighters, barges, floating docks, etc., where weight is of little importance. In our October issue reference was made to the fact that Lloyd's Register of Shipping had approved plans for the building of a number of ferro-concrete ships up to 500 tons deadweight capacity. The decision was come to after an investigation by one of the society's surveyors of the progress being made in the direction indicated by Norwegian interests. One feature of ferro-concrete construction, as compared with that of steel for ships, is the impossibility of determining whether the workmanship and material have combined towards the creation of the perfection of structure aimed at. Again, the tensile strength of reinforced concrete is more or less limited, being largely dependent on the extent to which reinforcing is carried.

The Beton I. is a ferro-concrete lighter, and was launched from the Porsgrund Cement Works, Norway. The method of launching, as will be noted from the illustrations, was unique in the annals of shipbuilding. The vessel took the water "bottom up," by intention, and was righted in some 15 or 20 minutes, the function in its every aspect being a complete success, and reflecting much credit on the cement works superintendent, Engineer Alfsen, who was responsible for the undertaking.

CONCRETE BARGE "BETON I." IMMEDIATELY AFTER LAUNCHING.

The lighter has a deadweight carrying capacity of about 200 tons, and will be propelled by a 70 horse-power Skandia motor. The structural calculations were performed by Engineers Bonde and Norman, while the vessel lines were drawn by a ship draftsman. It was found that previous calculations for structural strength of lighters and pontoons could not be made applicable in the case of the Beton I., as these had been designed for river and inland water service generally. Considerably heavier reinforcement had to be adopted, besides a much "fatter" mixture without cobbles had to be employed. The hull walls were made 1.97-in. thick; the depth of ribs on bottom and at sides, 23.6 in. and 9.8 in. respectively, and their thickness 5.9 inches.

In building the Beton I., about six weeks' time was consumed in erecting the forms and placing the reinforcement, the period being about equally divided between each of these operations. Needless to say, from the experience gained, a material reduction in the time taken



SKELETON PROFILE AND DECK PLAN OF CONCRETE BARGE "BETON I."

CONCRETE BARGE "BETON I.," SHOWING FIRST STEP IN RIGHTING.

is anticipated. Pouring of the concrete took two days and was more or less continuous, due to the fact that everything was complete and in order as far as reinforcing and forms were concerned. Three weeks was allowed for the concrete to set, the extended time being on account of the strength of the mixture, 1:2. From 50 to 60 men were employed in the pouring operation, the latter, as well as the subsequent operation of polishing, being carried out by hand and by pneumatic appliances designed and constructed by the builders. As in the case of forms for reinforced concrete structures ashore, the erection arrangements were such as to permit of ready removal and utilization on similar vessels to be built. For the following data covering the launching arrangements and function we are indebted to "Engineering," London, England:

Launching Data

The feature of the launch is associated with the fact that, for facility in arranging the reinforcement of the concrete, the vessel was built bottom upwards, and the platform on which it was completed was sent down the ways. In order to ascertain the different phases and conditions of the process, M. Alfsen undertook a number of experiments with a model representative of the barge.

CONCRETE BARGE "BETON I.," SHOWING THIRD STEP IN RIGHTING.

Care had to be exercised to ensure that in launching the vessel, from being stable, should become the reverse, or nearly so; thus the uprighting took place automatically, or by using very little power. The main principle was that the air under the "arch" should be partly released. The uprighting, to begin with, proceeded slowly, in the intermediate position it accelerated, the working moment at that point being greatest, and then again more slowly, until the moment becomes zero. The turning took place very neatly, without any shock, and the vessel had then, of course, to be emptied.

The launch of the vessel took place in the presence of a distinguished gathering, including the Premier, Mr. Gumar Knudsen, and the "provision" minister (a new post, an outcome of the times), M. Oddmund Vick. The hull looked like a big whale in its proper element, and a number of workmen, headed by the foreman, went on to the hull to open the circulation pipes, of which there were four on each side. The air began to flow out, the vessel began to lean over to port, and shortly afterwards, on the starboard side, the counter rail became visible above the water. In a few minutes the hull had righted itself. The Premier, himself an old engineer, much interested in engineering exploits, and a large shipowner, at a subsequent gathering made a complimentary speech, in which he congratulated M. Alfsen on the extremely successful and interesting launch according to his new method, and stated that the ferro-concrete shipbuilding industry might become of vital importance to the country.

The Porsgrund company looks upon it as essential that this class of shipbuilding should be carried out on an extensive scale of the standard types which may be chosen, and no doubt is entertained as to it being possible to build vessels extremely quickly and cheaply on these principles. The company intends to build, by degrees, very much larger vessels, fully fit and seaworthy for oversea traffic. A subsidiary company, working

CONCRETE BRIDGE "BETON I.," SHOWING SECOND STEP IN RIGHTING.

CONCRETE BARGE "BETON I." ON EVEN KEEL.

on the same patents, has already been started in Western Norway at Ytre Arne, near Bergen; the installations are being pushed ahead, and the first ferro-concrete vessels from that yard are expected to be taken in hand shortly and ready for delivery within a few months.

HONG KONG BUILT MOTOR YACHT FOR VANCOUVER OWNER

ONE of the most interesting yachts on the Pacific Coast of North America is the Iphis, owned by D. H. Bale, of Vancouver, B.C. This craft was built in Hong Kong, and it is interesting to note the skill shown by the Chinese when under British direction, although Mr. Bale admits that the native builder is anything but speedy.

The Iphis is 65 ft. long and 13 ft. beam and was designed by Morris, Bulkeley & Halliday, of Vancouver, although built in the yards of J. W. Kew & Co., of Hong Kong. All the wood used is teak, yacal or rosewood, and every fastening is of copper. The boat is copper-sheathed from the bottom of the keel to above the water-line, and she took seven months to build at Hong Kong with from 35 to 65 men working on her for 12 hours a day, Mr. Bale supervising the job himself. The interior is highly finished, and there are berths for eleven people, beside two berths in the engine-room. The owner's cabin has a bed 6 ft. 6 ins. by 4 ft. 6 ins. a lounge, dresser and extra mirror, with clothes lockers and drawers. All the drawers are of camphor wood, which keeps out moths and insects.

The saloon has transom berths and a swing table, with sideboard on one side and wine cupboard on the other. An English fireplace with the hearth and marble sides and front is at one end, while the upholstery all over the boat is in morocco leather except the forward cabin, which is "car plush." The gallery has a four-hole English yacht range, a dresser, white enamel sinks and dish racks. There is also a refrigerator, which will keep ice for 13 days. The bath-room has a tile bath and floor, with basin and mirror, while hot and cold salt water and hot and cold fresh water are available. Two lavatories are provided, one aft and one forward, both very roomy, with lockers, wash-basins, etc.

CONCRETE BARGE "BETON I." BEING BROUGHT ALONGSIDE WHARF.

The engine-room has a steel floor, and contains a six-cylinder 70 h.p. Buffalo paraffin engine with Bosch dual ignition and air starting. A speedometer is attached to the engine. The electric plant consists of a direct connected 3 h.p. engine and 35-volt generator. Deck fittings and, in fact, all metal parts whereever possible are of brass, the rudder being of bronze. There are three watertight bulkheads to minimize the danger from collisions.

Mr. Bale is understood to have accepted a position with an English firm in China, and expects to sail the Iphis right across the Pacific.—Motor ship.

MARITIME SHIPBUILDING

NEWFOUNDLAND has taken more than twenty of the new vessels built in Nova Scotia this year, and from twenty to twenty-five old vessels, the latter chiefly of small tonnage. Ten vessels have also been sold to other countries. Thirty three-masters are now on the stocks in Nova Scotia besides smaller craft, and next season's launchings promise to be the greatest in number and tonnage of any year within recollection. One Nova Scotia vessel has gone to Chili and two others to Australia.

Even if the war should end to-morrow, says an expert in shipping, we would still have a good many years of high freights, for every part of the world is in such need of commodities and so many steamships have gone to the bottom that there is no possibility of the supply of shipping exceeding the demand for a few years. It takes eight months to build a wooden ship so, even with all working, the output will be moderate in volume as compared with the demand.

EFFECT OF OIL ON ROUGH WATER

WAVES in mid-ocean are caused entirely by the action of the wind. The adhesion between the rapidly moving particles of air which compose the wind and the surface particles of the water causes the water's surface to be dragged along with the air. Small ripples are immediately formed, and these soon overtake others near them. They unite, and, due to the friction between the water particles, each succeeding ripple piles up on the top of the previous ones. Just as soon as oil is spread on the water, however, the size of the waves is reduced like magic. The reason for this is interesting. Oil, unlike water, has very little internal friction between its particles. The ripples of oil formed by the wind, therefore, cannot pile upon each other to any considerable height; hence water waves cannot grow in an area of oil placed about a steamer. They begin to fall down instead. By the time these waves reach the boat they will have lost their formative ripples, and the result is a perfectly calm surface over the portion of the sea through which the boat is making its way.

U. S. Standard Wood Steamships and Their Equipment

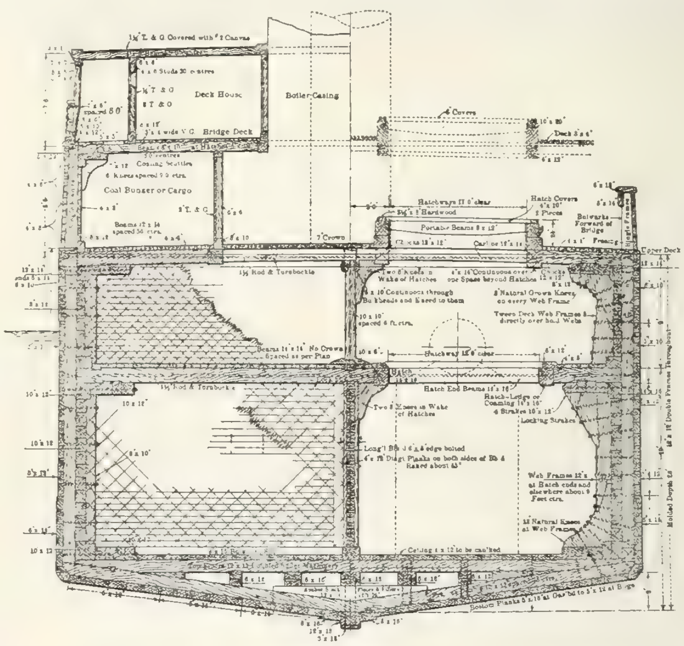
By C. T. R.

Wood as well as steel ship construction features the activities of the United States Emergency Fleet Corporation. In Canada also, wood craft are being built in large numbers — numerically, perhaps, more so than those of steel. There is this difference, however: While the majority of our wood ships are either wholly dependent on sails or on sails supplemented by auxiliary power, those building in the United States are equipped with regular marine type, standard engines taking steam from standard type water-tube boilers.

A REASONABLY good idea of the design, constructional, and equipment features of the 3,500 tons deadweight, standard wood ships of the U. S. Emergency Fleet will be had from the accompanying profile, main deck plan, and midship section. The propelling machinery consists of two sets of standard, direct-acting, triple expansion, reciprocating engines, supplied with steam from two standard type water-tube boilers, at a working pressure of 200 pounds per sq. inch. The boilers operate under induced draught and, if occasion arise, geared turbines can be installed instead of the reciprocating engines.

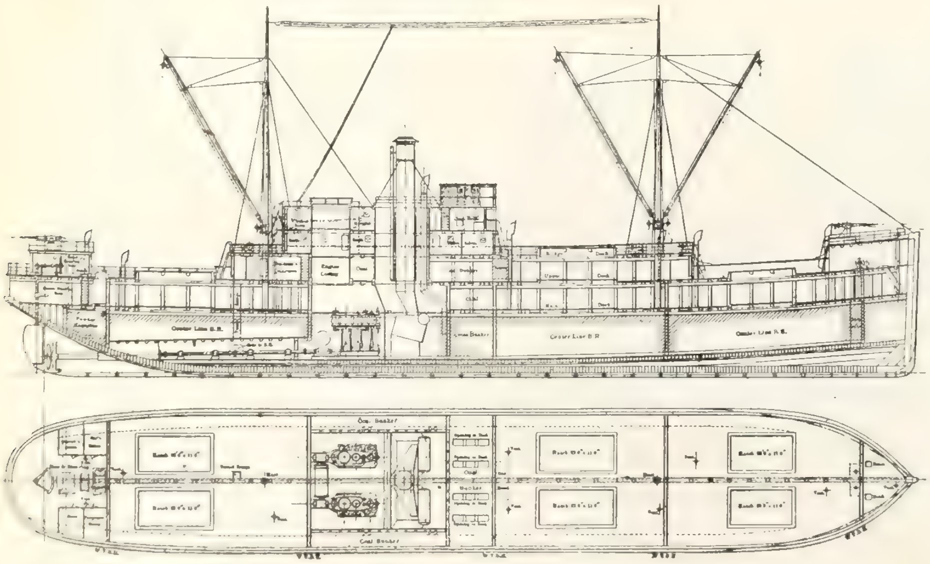
Six transverse bulkheads in the 'tween deck space and five transverse bulkheads below the main deck are fitted, while a double bottom runs from the forward collision bulkhead to the inner end of the stern tube. This double bottom is in turn subdivided at the main bulkheads. A longitudinal centre line bulkhead extends from the forward to the after collision bulkheads as far up as the main deck. Cargo is handled through three sets of twin hatches by means of six cargo booms of 5 tons capacity each, fitted to the masts and served by steam winches. Provision is made for storage of 80 tons of fresh water and 30 tons for culinary purposes, the fresh water being carried in steel tanks located in the machinery space, and in the stern of the ship.

A raised forecastle deck and house aft provide gun platforms, on which will be mounted suitable rapid fire guns for defence and offence, should the vessel be subject to submarine attack. Above the bridge deck amidships is the boat deck, and in the midship deckhouses all of the crew will be quartered.



MIDSHIP SECTION U.S. STANDARD WOOD SHIPS.

Each vessel is being equipped with up-to-date efficient auxiliary machinery for the various board-ship services. Among the individual units are to be noted an electric lighting installation, steam winches, windlass, capstan, and steering engine; hand steering gear, refrigerating machine, steam heating system, pumping apparatus for both ship and engine room duty, etc.



PROFILE AND MAIN DECK PLAN, U.S. STANDARD WOOD SHIPS.

LIGHTHOUSE CLOSING DATES

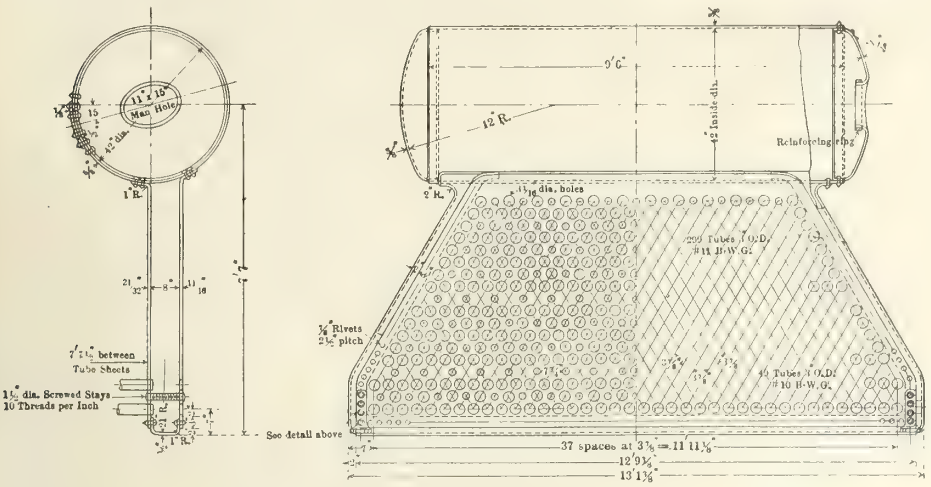
THE following circular, bearing date of October 12, was issued from the Department of Marine at Ottawa, regarding the operation of lights on the Great Lakes this fall, up to the close of navigation. A copy of the regulations is as follows:—

"All Canadian lights and fog alarms on Lake Superior will be kept in operation this autumn until the close of navigation, with the exception of Caribou Island, Otter Island, Quebec Harbor, Michipicoten Island, Michipicoten Island east end, Carguntua, Michipicoten Harbor, Corbeil Point and Ile Parisienne, which may be closed on December 20; also Slate Island, Battle Island, Lamb Island, Shaganash, Point Porphyry, Thunder Cape, Welcome Island, Pie Island and Victoria Island, which will be closed after the last sailing to or from Fort William or Port Arthur.

"All Canadian lights and fog alarms on Lake Huron, Georgian Bay, Lake St. Clair, Lake Erie, Lake Ontario, and connecting waters, will be maintained in operation until the close of navigation, excepting the south-east shoal lightship, Lake Erie, which will be removed on December 12, and also Lonely Island light, Georgian Bay, which may be closed before the general close of navigation.

"All Canadian lights on the St. Lawrence will be maintained in operation until the close of navigation.

"All gas buoys and other floating aids to navigation will be maintained in position as long as ice conditions will permit, and in cases where it is necessary to remove gas buoys before the close of navigation, the important points will be marked by spars."



WATER TUBE BOILERS FOR U.S. STANDARD WOOD VESSELS.

"VICTORY" PLANT BEING PUSHED TO COMPLETION

THE new nine million dollar destroyer plant which the Bethlehem Steel Corporation are having built at Fore River, near Boston, is going ahead rapidly and the Aberthaw Construction Co. has set a new record of speed on this work. In addition to the main plant, work is going forward on Victory Plant No. 2 at Buffalo which is to be occupied by the Bethlehem Steel Corporation about January 15, 1918. In this plant the propelling turbines are to be made for the destroyers. The Buffalo plant will occupy fifteen acres of land, near Tonawanda, and the main building will be 750 feet by 200 feet, with a boiler house and administration buildings added. The construction throughout will be of steel and concrete, over 1,500 tons of steel being used.

The turbine engines will be built at Buffalo and then shipped to Squantum for installation in the destroyers. Snow has not hindered the work of construction, although for several days during the first of this month, the fall was around five or six inches and covered the fifteen acres where the work is being done. The land, although not low, is of a clay substance and water and melting snow stood upon it. This required the contractors to raise the grade about two feet.

The cost of the construction of this plant, aside from that at Squantum, will be $1,500,000. Power for its operation will be furnished by a new power house recently erected at Buffalo, by Stone & Webster, of Boston. This is a mile away from the turbine plant. Street car lines as well as the railroad run to the plant.

A flag raising took place at the plant November 16, the mayor of Buffalo and a representative of the Navy Department, United States sailors and marines officiating at the ceremony.

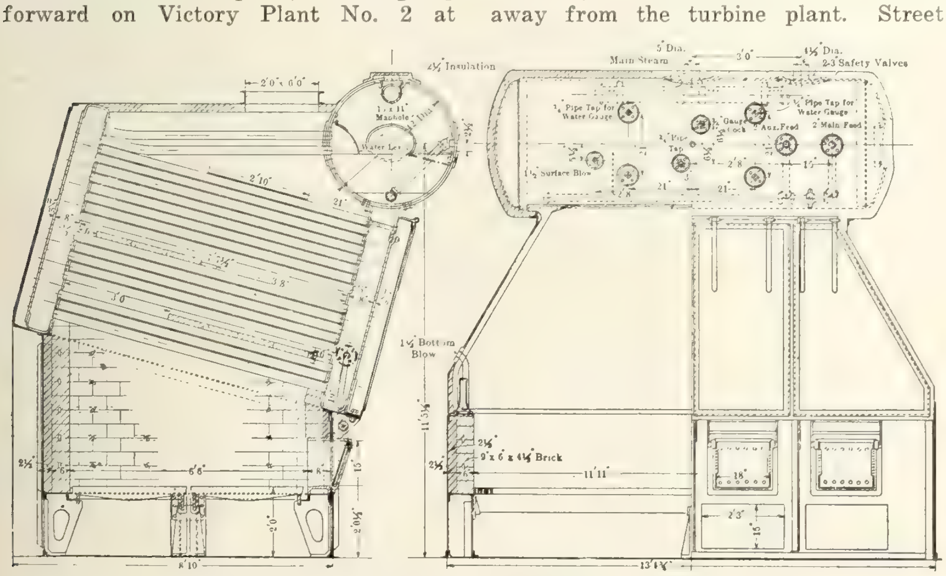
L. C. Manuell, of the Bureau of Yards and Docks of the Navy Department at Washington, represents the Government at the plant and has general supervision of everything. The work on foundations for the big main building has progressed so rapidly in spite of weather conditions that steel construction was started the week of November 12.

SHIP CONTRACTS VALUABLE

SINCE the official statement of the Emergency Fleet Corporation of the United States Shipping Board showing the number and tonnage of vessels under contracts requisitioned and contracts pending, another contract for sixteen 7,500-ton boats is reported to have been placed. When the statement was issued, ninety-nine ships of 610,000 tons capacity were still under negotiation. According to recent Washington estimates, the ships acquired by the Fleet Corporation have cost the Government on the average $175 per ton. The Shipping Board, therefore, has become obliged to pay $1,356,916,400 for the ships requisitioned or already under contract for construction. Including the ninety-nine ships, contracts for which are pending, the total expenditures for all types of cargo ships will be approximately $1,464,000,000.

The building of the 1,409 vessels being acquired by the Government, including 33 ships of 257,570 tons already completed and released, will require almost 2,300,000 tons of steel shapes and plates. In addition the building of battleships, torpedo-boat destroyers and other war craft by the navy will call for 450,000 tons of plates and shapes, or a grand total of 2,750,000 tons of steel to fulfill the Government shipping programme.

OXYACETYLENE welding played an important part in repairing the damage done by the German crews of the ships recently taken over by the United States Government. Its inspectors discovered that extensive use had been made of oxyacteylene cutters to partially cut through the joints and hull-plate seams. In almost all the ships interned in New York harbor this had been surreptitiously, but skilfully, done, and the sections cut had been carefully painted over, so that all traces of the work were obliterated. The purpose evidently was so to weaken the hulls and supports as practically to assure the sinking of the steamers when they again put to sea. Fortunately, the damage was discovered, and it is gratifying to know that the scientific welder can thoroughly repair every part injured. The steamer which sustained the most damage was the best of the fleet, the Vaterland, valued at ten million dollars.



DRUM, HEADER AND TUBE SHEET, WATER TUBE BOILERS FOR U.S. STANDARD WOOD SHIPS.

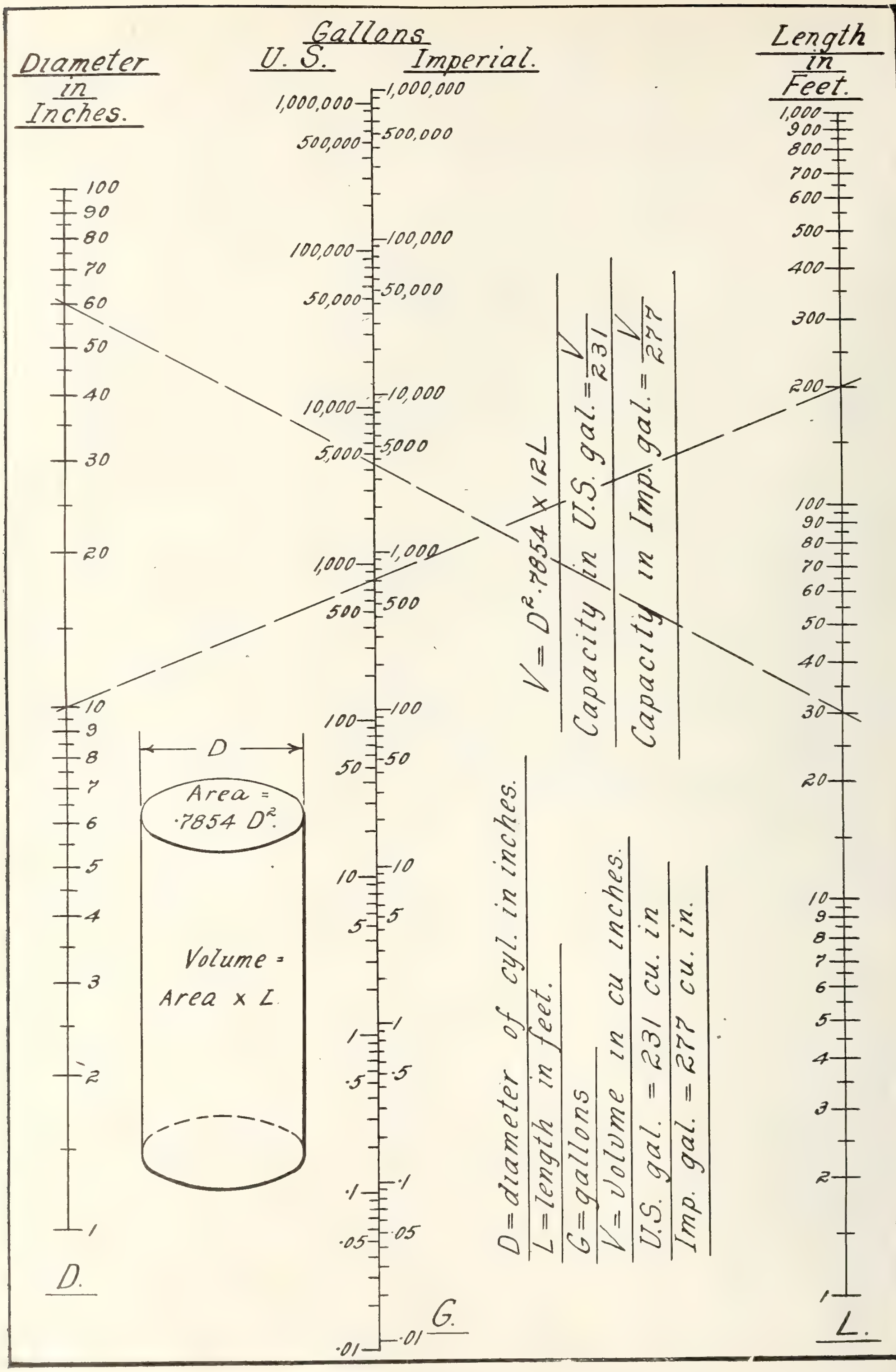


CHART OF CYLINDRICAL TANK CAPACITIES.

CAPACITY OF CYLINDRICAL TANKS

By J. H. R.

CALCULATIONS for the capacity of cylindrical vessels are often tedious work to those not very familiar with the method by which these results are attained. While many handbooks can be had that give the tables for the various capacities for certain diameters, it is invariably the case that the time occupied in securing the desired information is greater than would be required to figure it out. It is well, therefore, to learn the principle by which these mental problems are solved. Generally speaking the capacity of a vessel is computed in gallons, while the dimensions are invariably given in feet or inches, and it is, therefore, necessary to determine the volume of the interior and find the corresponding capacity for such a volume. The volume of a cylindrical vessel is found by multiplying the area of the base by the length or height. The area is .7854 times the square of the diameter; for instance, it is desired to find the volume of a cylindrical tank 15 feet in diameter and one foot deep. The area of the base would be $.7854 \times D^2 = .7854 \times 15 \times 15 = 176.7$ sq. ft., and one foot in height would give a volume of 176.7 cu. ft. One cubic foot of water contains 6.23 Imperial gallons or 7.48 U.S. gallons; therefore the capacity of the above tank in Imperial gallons would be $6.23 \times 176.7 = 1100.8$ Imp. gallons. In United States measure the capacity would be $7.48 \times 176.7 = 1321.716$ U.S. gal. In smaller tanks where the diameter is usually given in inches and the respective volumes of an Imperial and U.S. gallon are 277 and 231 cu. inches, it is customary to use these latter values in calculations.

A cylindrical tank 60 inches in diameter and 30 feet long would have a volume of $.7854 \times D^2 \times L = .7854 \times 60 \times 60 \times 30 \times 12 = 1,017,878$ cubic inches. The capacity in English measure would be $1,017,878 \div 277 = 3674$ Imp. gal. In U.S. gal. the capacity would be $1,017,878 \div 231 = 4406$ gal.

To convert Imperial gallons to United States gallons multiply by 1.2; thus, in the above example $3674 \times 1.2 = 4408$ U.S. gal. To convert U.S. to Imperial multiply by .833.

$4406 \times .833 = 3671$ Imp gal. The small differences in the values result from the slight error in decreasing the number of decimal places in the constants 1.2 and .833. These constants are derived from dividing the respective volumes by each other; as 277 divided by 231 gives 1.199, and 231 divided by 277 gives .833.

It is often possible that an approximate value is sufficiently accurate for tank capacities, and for this purpose the accompanying chart will be found of great service. On the graduated scale D, to the left, are given the various diameters of tanks in inches, and in the right-hand column L the length in feet. A straight line drawn from any two points on the two outer scales will intersect the middle column G at the approximate capacity in U.S. and Imperial gallons.

ROMANCE OF "WIRELESS"

WIRELESS telegraphy is playing an extraordinarily important part in the war. Its uses were foreseen, up to a point, before hostilities began, but its developments have been beyond the wildest pre-war imagination. Every moment it is figuring in the great world drama, and almost day by day we are receiving illustrations of its principal part in what may be called the sub-dramas of the conflict raging over so large a portion of old Earth's surface.

It is difficult to say which is the more wonderful and intensely interesting—the manner in which wireless co-ordinates an army's many activities in the field or that in which it narrows the seas. Wireless at sea has had its more widely known romances, perhaps. It has an important share in the conduct of the submarine campaign—and a greater one in meeting it. Our patrol boats in their thousands, our destroyers and submarine hunters in general, have ranged the water unceasingly, always on the alert for their prey and for news of where submarines may be operating. In the majority of cases the news comes by wireless. A merchant ship, say, is attacked by one of the pirates. Out go her aerial signals, to be picked up by vessels near and far, warning passenger or cargo boats of the place where there is danger and inviting the fighting craft to the rescue.

Of such episodes scores stand out as spies. One of the most thrilling was the adventure of the Anglo-Californian, a vessel which was homeward bound from Montreal with a cargo of horses, and was chased and shelled by a submarine. At once the wireless operator, J. F. Rea, sent out the news into the air. Many miles away it was picked up by a warship. Then ensued a long-sustained and poignant wireless dialogue. The warship was coming along at top speed, and the Anglo-Californian's wireless man was telling of the progress of the chase. Fight it could not be, as the merchant vessel was unarmed. Shell after shell tore into the ship, but the gallant captain proceeded on his way, meeting the submarine's tactics with skilful navigation which kept the pirate astern, the while he followed as well as possible the wireless instructions, as to his course, received from the warship. An hour passed; two; three. The Anglo-Californian, told to hold on as long as possible, was grimly enduring a terrible bombardment in which the captain, eight hands, and 20 horses were killed. "For God's sake, hurry up. Firing like blazes," was one of the messages radiated by the wireless man to the warship. Mr. Rea was lying on the floor of his room with broken glass all around him, and "the place stinking with gunpowder," as he told the warship by wireless.

The submarine, in the event, was foiled. After four hours of effort she had to dive, apprehending trouble from the warship, and the survivors on the Anglo-Californian proceeded on their way in due course, later to receive a high tribute from the Board of Admiralty. Mr. Rea was presented by the Board with a gold watch in recognition of his conduct (brilliantly described by Alfred Noyes in those wonderful articles of his) which saved the situation.

Many columns could be filled with fine stories of the share of wireless in sea warfare. Our fleets have a conspectus of the North Sea by the aid of wireless, the messages coming from the patrol ships on the water and the aircraft which traverse the sky in all directions above. German submarines use wireless, and act according to instructions received, from Heligoland or elsewhere, through their aerials. A British aviator may detect a submarine below the surface and wireless to a handy destroyer, which may therefore be able to trail the pirate to his doom. During the battle of Jutland, Jellicoe and Beatty owed much to wireless; and there are stories of how Von Spee intercepted and misconstrued radiated information and inquiries emanating from Admiral Sturdee. In short, whatever is happening on the sea nowadays becomes known through wireless.

EMBARGO ON IRON AND STEEL

EXPORTATION from Canada of iron and steel in unfinished or semi-finished forms, suitable for use in manufactures, will be prohibited by the Dominion Government, except under license from the Department of Customs. The classes of iron and steel goods upon the sale of which outside the Dominion an embargo is placed include pigs of iron, steel, ingots, billets, rods, shapes, angles and plates.

The prohibition of exportation is due to the serious shortage of iron and steel for munition making, shipbuilding and other manufactures. The United States Government has placed restrictions upon the exportation of iron and steel from that country, and has established a priority board to pass upon applications for export licenses. That board will give precedence to requests for steel for munition and other war supplies and for shipbuilding. It will then consider the needs of railways, railway car and locomotive building firms, and other industries.

Canadian manufacturers have conferred together with a view to laying their requirements before the United States priority board. It has been felt that at a time when Canada is applying to the United States for iron and steel it should itself take steps to conserve the domestic output of such material for domestic uses. Export licenses will be granted by the Customs Department only for very special reasons.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

"ARANMORE"—"CYRENE" COLLISION

AT Charlottetown, P.E.I., on Aug. 31, before Capt. Demers, Dominion Wreck Commissioner, assisted by Capts. Alex. McLeod and J. Lumsdane, an investigation was held into the causes which led to the collision between the SS. Aranmore and the schooner Cyrene in Pictou Narrows, at the entrance to Pictou Harbor, on Aug. 27, resulting in the sinking of the Cyrene. Captain D. M. MacDonald of the Aranmore was represented by Mr. McKinnon, K.C., on behalf of the Imperial Merchants Service Guild, while Mr. Johnston, K.C., acted for Captain Murphy, Captain and manager-owner of the Cyrene.

By consent, Captain D. M. MacDonald was the first witness called, and he deposed that he was 40 years of age, and held master's certificate of competency No. 351, issued by the Colony of Newfoundland, that the Aranmore is an iron built, single screw vessel of 502 tons net and 1,169 tons gross, carrying a crew of 44, with an average speed of 11½ knots; that her draft at the time of collision was 10 ft. 10 in. forward and 15 ft. 10 in. aft, that at the time there were between 200 and 300 passengers on board, and mail and cargo, that he left Pictou Wharf at about 6.30 p.m., and when on his course he saw two vessels, one heading NW., the other NE., at the Narrows, he having a two knot current with him at the time on ebb tide, which, with his speed of 11½ made 14 knots over the ground.

When near the schooner on his port bow tacked, the other being one point on his starboard bow, and at 6.43 he sounded standby, 6.44 full astern, having first starboarded, but later ordering hard aport.

He noticed the captain of the Cyrene leaving the wheel and slackening the main sheet, the schooner's head paying off at the time he hard aported, and the collision occurred, his steamer striking the schooner on the port side forward of the main rigging, making a large hole in her side.

The two men and a boy came on board over the bow, the master of the Cyrene later returning to his schooner, and leaving same in a small boat, and shortly after, the schooner, having sailed away further in, capsized.

He stated he could not go around her stern as there was not enough water for his vessel, but he saw a possibility of passing between the two schooners, and, he says, if the schooner had not altered her course there would have been no accident.

Supplementary evidence was submitted by the first officer, quartermaster and second engineer of the Aranmore.

Captain Murphy of the schooner Cyrene stated that he was 53 years of age, held no certificate, but was master and managing-owner of this vessel, having only another man on board, besides his ten year old son, who was a passenger on a vacation; that he was tacking, facing a current of 2½ knots with a light breeze, his vessel going about three knots through the water; that he had a reef mainsail, having anchored before earlier in the day; that there was a strong breeze two hours before but he did not shake the reef out as he intended to anchor again off Moody Point; that he was on the port tack and in order to avoid colliding with schooner Henry Dicks he paid off his main sheet and allowed the head to fall off two points and the steamer struck him whilst in that position. He said there was plenty of room for the steamer to pass astern of his vessel.

Captain Boucher of the schooner Henry Dicks gave further evidence following which the court arrived at a finding.

Finding

The court holds the master of the SS. Aranmore, Captain Daniel Michael MacDonald, in default for daring, foolhardy navigation, bordering on carelessness, and suspends his master's certificate, No. 351, for a period of nine months from September 1, 1917, to June 1, 1918.

The court also held that Capt. Murphy of the Cyrene altered her course to cross ahead of the steamer, in direct violation of the rule of the road.

Had she kept her course no word of condemnation would have been launched against the captain of the Cyrene; but in view of this direct breach of the rule of the road the court finds the Cyrene to some extent, invited collision, causing the master of the Aranmore to change his helm from starboard to hard aport, and therefore the court concludes the Cyrene is partly to blame for the casualty; but as the captain had no certificate no other action than a charge of default can be taken by this court.

"STUART W"—"TWIN SISTERS"—"MENOMINEE"—"KILDONAN" COLLISION

BEFORE Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Capts. Francis Nash and Charles Lapierre, a formal investigation was held in the Wreck Commissioner's Court on Sept. 5, 6, and 25, into the causes which led to the collision between the steamer Stuart W. and barges Twin Sisters, Menominee, and Kildonan, whilst in tow of tug Sin Mac, resulting in the grounding of the Menominee and Kildonan, in the Upper St. Lawrence River, near McCoy Island, July 20. A. R. Holden, K.C., represented the owners of the tug and barges, and A. B. McMaster, K.C., the owners of the steamer.

Ernest Tremblay, master of the Stuart W., deposed that he was proceeding with the current which runs at that place about two miles an hour; that when near McCoy and Montgomery carried out for a short period of time Islands he blew one whistle, being about a quarter of a mile from the tow then; that a fresh breeze was blowing; that he blew one whistle meaning to slow the engines, and when 300 feet distant he blew the alarm signal and went full speed astern. He struck the barge Twin Sisters sideways, on her port quarter, then the barge Menominee on the bow, parting the tow ropes, then passed between the stern of the Menominee and the Kildonan, parting the tow rope, the Kildonan, helpless in the current, going ashore on McCoy Island, the Menominee drifting sideways into the Kildonan, and the Twin Sisters remaining in tow of the tug Sin Mac.

Pilot Leduc said the Sin Mac was on the north side of the centre line of the channel, which is about 500 feet at that place; that he heard but one whistle from the Stuart W and altered his course more northerly.

Captain Legault of the Sin Mac said that he was in bed but was awakened by the mate; that he came on deck and saw the Stuart W striking the Twin Sisters; that the wind at the time had diminished; but that it had been blowing strong. He had been up for a long spell before retiring. His vessel was making 8 knots through the water.

After several other witnesses had been examined the court arrived at a decision.

Finding

The Stuart W was a descending vessel and therefore had the right of way, and accordingly gave the first indication that she would keep on the right side. Both vessels were head on to each other and practically in mid channel. This signal was timely given, and duly answered by the Sin Mac; but as it is averred by the Stuart W that there was a strong breeze blowing, if a judicious examination of the condition existing had been observed, the Stuart W had

the right to ask to pass to starboard of the tow. As it could, or must have been seen, that the barges were affected by the strong wind then blowing, a windward place could have been asked.

Article 25 of the Rule of the Road for the Great Lakes, which is explicit as to the right of the descending vessel to elect as to which side he may pass, covers this.

In this case, whilst the Sin Mac appeared to be head on, it could not be the position with respect to the barges or her tow, which, if the evidence is accepted of either side must have been to the southward of the mid channel line. Such being the case the Stuart W was in his right to demand by two short blasts, the passage to the north. The court admits that the situation demanded the exercise of quick action and proper judgment, which was not done in the case of the Stuart W.

As shown by the evidence, the court is of opinion that the Sin Mac violated article 25 in not awaiting the passage of the Stuart W when off Royal Island, or when first seen. The onus of violation rests with the pilot Leduc for infraction of Article 25 and for not calling the master when the Stuart W was seen. As he is engaged as a pilot only, and possesses no license as such, the court can only administer a severe censure on his actions.

The master of the Stuart W was severely reprimanded for not availing himself of the privilege granted to him by Article 25; but especially for maintaining his speed when danger was possible, and in a narrow pass. On the part of both vessels there has been a violation of the rules of the road.

SPECIAL PRECAUTIONS WHEN A VESSEL IS IN A SUBMARINE AREA OR DANGER ZONE

THIS notice is a new edition, with important alterations and additions, of two notices previously issued by the Board of Trade with regard to the special precautions to be taken when British vessels go through a danger zone. The preceding notices were issued in August, 1915 (Notice 365), and May, 1916 (Notice 374); and these notices are now cancelled. This notice, which is issued after consultation with the Ministry of Shipping, applies to all sea-going British merchant ships, whether chartered or requisitioned by His Majesty's Government or not. Areas in which there is a possibility of attack by enemy submarines or collision with mines are indicated in the Admiralty instructions to masters.

2.—When a ship strikes a mine or is torpedoed it is impossible to rely on there being sufficient time to take measures to keep the vessel afloat. Experience has shown that open water-tight doors, and open side scuttles or other apertures in the ship's side have caused the loss of vessels which might have remained afloat. Further, as the damage by a torpedo or mine may be so great that no measures could keep the vessel afloat for long, arrangements made in advance for getting all persons on board into boats or upon rafts are of great importance.

It is essential, therefore, that where a vessel is going through dangerous waters, all possible arrangements, in view of an attack by submarine or collision with mine, should be made in advance; and those concerned should take, or ensure the taking of, the precautions in this notice, which has been drawn up after careful consideration of the facts relating to the loss of a large number of vessels through mine or torpedo. Owners and masters are primarily responsible for taking these precautions, or for ensuring that they are taken.

3.—In addition to the precautions indicated in this notice, those concerned should take any special and additional measures that may be necessary in particular circumstances. Attention is called to the serious consequences in which those responsible would be involved should the loss of a ship, or loss of life, result from the omission to take any necessary precautions.

4.—This notice comes into operation immediately upon issue, but if full compliance with any requirement would seriously delay the sailing of a vessel, such compliance may be deferred. In such cases temporary arrangements should, wherever possible, be made to secure as far as practicable the objects in view; and the whole of the requirements should be carried out as soon as practicable after the issue of the notice.

Water-Tight Bulkheads and Tunnels

5.—Care should be taken to maintain all bulkheads and tunnels, which are intended to be water tight, in a thoroughly water-tight condition.

Water-Tight Doors

6.—Doors in water-tight bulkheads, which are not essential for the working of the ship at sea on the intended voyage, should be closed and secured in that position before the voyage commences and kept closed while at sea. All water-tight doors in passageways from firemen's quarters to the stokehold should be kept closed, the firemen using the fidley ladders. Where suitable provision is made for the exit of the crew or passengers from their quarters by means of ladderways through the deck above, the water-tight doors which are required solely for access to those quarters should be kept closed.

In all cases where this is practicable, a water-tight trunk should be fitted from the bulkhead deck to the shaft tunnel, and the tunnel door kept closed. All possible arrangements should also be made to enable water-tight bunker doors to be kept closed in a danger area; *e.g.*, if there are side bunkers or bunkers the doors to which are in non-water-tight bulkheads, coal should be worked from these in danger areas and the doors in water-tight bulkheads kept closed. In other cases, shoots should, if practicable, be fitted so that coal carried between decks or in the bridge space may be used and the opening of lower water-tight doors be avoided. Failing these possibilities, as much coal as practicable, having regard to safe working and weather conditions, should be stowed on the stokehold plates for use in the danger zone.

If it is impossible to work the ship at sea without opening some particular door, the door is only to be opened when absolutely necessary, and with the express permission of the master. During the time that such doors are open, the members of the crew detailed for this work should be ready to close them as soon as the order is given. The door should be closed again as soon as possible, and the fact reported to the master at once.

7.—All water-tight doors which are liable to be opened at sea should be kept in thorough working order, and should be capable of being closed expeditiously. Doors worked by a ratchet cannot be closed quickly enough, and whenever possible the ratchet should be supplemented by a wheel and handle or by some other gear giving continuous closing action.

8.—The master should appoint the chief engineer or some other officer, as the person definitely responsible for the working of the water-tight doors in each part of the ship. Before the ship proceeds to sea on any occasion such officer should have the doors opened and closed in his presence, and should satisfy himself that they are in good working order, and can be quickly closed. An entry should be made in the official log, and signed by the master and by the responsible officer every time this is done.

Before the ship leaves the United Kingdom at the beginning of a voyage the officer responsible for the doors in each part of the ship should give the owner or his marine superintendent a certificate in writing to the effect that the doors were worked in his presence and closed to his satisfaction, and should report to the master that he has done so. Opportunities should be taken as often as possible during the voyage to see that the doors remain in good condition, and door drill should be practised at regular intervals, an entry being made in the official log on each occasion.

9.—Great care should be taken to ensure that any portable plates on the bulkheads or tunnels, any manholes in double-bottoms, or any sluice valves are thoroughly closed water-tight before the ship proceeds to sea.

Bilge Pumps

10.—All bilge-pumping installations should be maintained in efficient condition. The bilges and strum boxes in each hold and machinery compartment should be cleaned, and any defects in the system remedied before proceeding to sea. If practicable an additional screw-down non-return valve should be fitted in each pipe line on the water-tight bulkhead inside the compartment in which the strum box for that line is situated. The valves should be secured to the bulkhead in each case by studs screwed into bulkhead.

Openings in the Ship's Sides

11.—All side scuttles and other openings in the ship's sides below the uppermost continuous deck and in the first tier of deck erections above that deck should

be kept closed so long as the ship is in a submarine area with the exception of apertures such as ash shoots which require to be opened for the working of the ship. Ash shoots and slop shoots should be fitted with suitable appliances for closing them water-tight unless the shoots extend to the bulkhead deck and at least 15 feet above water and the shoots should be kept closed except when actually in use. Sanitary discharges and scuppers not fitted with appliances which will be water-tight under pressure should, if below the bulkhead deck and less than 15 feet above water, be closed up, and, if necessary, other arrangements made. Any other sanitary discharges, the use of which can be dispensed with, should also be closed up.

Where side scuttles below the uppermost continuous deck are fitted with inside metal dead lights and/or outer metal plugs, the plugs should be shipped in place and the dead lights closed; but if the side scuttles are not provided either with dead lights or outer plugs they should be permanently closed and made water-tight by riveted or bolted plates or in some equally efficient manner unless they are at least 15 feet above water.

Berthing of Passengers

12.—All passengers should be berthed when in a danger zone above the uppermost continuous deck if there is sufficient accommodation, and the water-tight doors and scuttles in the passengers' quarters below that deck, as well as any sanitary discharges connected with those quarters, should be kept permanently closed.

Lighting

13.—All living and working spaces liable to be rendered dark through the closing of side scuttles should be provided with adequate artificial light. In addition provision should be made for giving light for egress from the living compartments to the deck and for launching of the boats and the embarkation into them of those on board. For this purpose lanterns placed in suitable positions are recommended, as electric lighting systems may be rendered inoperative by a mine or torpedo explosion. Lanterns should be kept burning in a submarine area but obscured from view until required. A supply of electric torches should also be provided.

Warning Engine-Room Staff

14.—Suitable provision should be made to enable the master or officer-in-charge to give immediate warning in case of emergency, to those men who may be on duty in the engine-room, stokehold, or other compartment below deck. A mutual understanding should exist whereby these men may know that they will receive notice by a signal agreed upon when it is time to leave their posts. The explosion of a mine or torpedo may result in the engine-room telegraph or telephone being disabled, and arrangements should, therefore, be made for conveying a message promptly in some other way.

Prevention of Heeling

15.—It is very important that a vessel should have sufficient initial stability to prevent her taking a serious list if holed by a torpedo or a mine. It is desirable, of course, that the freeboard of the vessel should not be unnecessarily reduced by the addition of water ballast, but if the nature or amount of the cargo, taken in conjunction with the amount of bunker coal on board is such at any time that a sufficient margin of initial stability cannot otherwise be obtained, some or all of the ballast tanks should be filled. The vessel should not, however, be overladen.

If the initial stability is not so ample as to prevent any danger of a serious list, and if the vessel is constructed with longitudinal bulkheads, such as wing bunker bulkheads, precautions should be taken to allow water which may enter the vessel to flow as freely as possible through the longitudinal bulkheads; for example, the doors of wing bunkers should in such a case be left open.

Emission of Smoke

16.—It should be realized that the presence of smoke which can be seen for many miles is often the only indication given to a submarine of the presence of a vessel. Particular care should, therefore, be taken with the stoking of the boilers when in a danger zone, so as to minimize the amount of smoke emitted. In this connection it is advisable to stoke lightly and stoke often, keeping the fires clean and even.

Precautions Against Shell Fire

17.—Wooden plugs should be prepared before the ship leaves port and kept handy to plug up shell holes. Suitable plugs can be made of spruce, about two feet in length and about 8 inches in diameter, tapering to two inches.

Lifeboats

18.—The lifeboats attached to davits should, if possible, whilst the vessel is in the danger zone, be carried in the outboard position gripped to spars or secured in some other efficient manner so as to be ready for immediate lowering. Inboard boats should be transferred to the ship's side under davits ready for hooking on. In order to provide protection for any passengers or seamen who may, in an emergency, be compelled to leave the ship without sufficient clothing, every boat should be furnished with a number of blankets rolled up tightly and properly stowed under the thwarts or elsewhere.

Boat drill should be practised and life-saving appliances examined as frequently as possible. Masters and officers should carefully inspect the boats and satisfy themselves that every lifeboat has on board all the equipment required by the Life-Saving Appliances Rules, including a sufficient quantity of provisions and water in good condition; that plugs are always securely attached to the margin of the plug holes; and that the boats' falls are so stowed as to be immediately available for use without liability to become fouled. For this purpose the falls should be wound on reels or stowed in some equally efficient manner.

Masters and officers should also impress on their crews that the safe lowering of a boat depends largely upon seeing that the falls are quite clear for running, and that while the boat is being lowered the men tending the falls lower in unison so as to keep the boat fairly level. In order to prevent a boat coming down with a run, where lowering bollards are not provided, a round turn should be taken with the fall round the davit below the cleat before the falls are coiled.

Each life boat should be provided with two painters; one should be fitted with a strop and toggle and the end should be led forward and kept belayed to a cleat or other suitable fitting fixed on the deck or bulwark, the boat's painter being coiled in the boat for use if required after launching. In the case of lifeboats stowed on the poop, or near the after end of the ship, the cleats should be so placed that boats when lowered and freed from the tackles, with the ship light, will be held by the ropes clear of the counter and propellers.

The covers of all lifeboats, and pontoon lifeboats should be taken off before entering the submarine area, and all obstructions, such as would prevent the lifeboats floating off the vessel's deck, should be removed, including the boats' gripes when weather permits. In order that they may have the best chance of floating clear, a number of the pontoon lifeboats (where such are carried) may, if necessary, be stowed elsewhere than abreast of davits.

Life-Rafts and Buoyant Apparatus

19.—Every passenger steamer which is, or may be, employed in a submarine area or danger zone, should be provided with life-rafts, buoyant deck seats, or other buoyant apparatus suitably stowed on deck, in addition to the lifeboats and other appliances required by the Life-Saving Appliances Rules. If possible the buoyant apparatus should be sufficient to accommodate 50 per cent. of the total number of persons on board.

20.—Rafts and buoyant apparatus should be stowed in such a manner that they will be free to float off the vessel's decks on their gripes being slipped. They should not be lashed or have any fastenings other than gripes. Wire-rope gripes fitted with a short length of chain and a slip link are considered the handiest form of quick release.

Life-Jackets

21.—Life-jackets should be so placed as to be readily accessible, or issued to the persons for whom they are available. In a passenger ship, the master must satisfy himself that every passenger has a life-jacket issued to him, has been shown how to put it on, and the correct position in which it should be worn, and has been instructed either to wear it or to keep it within immediate reach ready to put on while the ship is in a danger zone.

Musters should be held at short notice as soon as practicable after leaving each port in the danger zone and at frequent intervals thereafter, at which all passengers should be required to attend with their life-jackets, putting them on under proper guidance. Not more than two types of life-jackets should be carried on board any one ship.

Warm Clothing, Etc.

22.—Passengers and seamen should be enjoined to keep themselves warmly clothed at all times, and to be ready for any emergency. The seamen's discharge books should be distributed to them on entry in the danger zone.

ALLIED POWERS TO POOL SHIPPING.

WITHIN the next few days, says a New York dispatch of Nov. 22, the Allies will have a most important announcement for the shipping world. This, according to report, will be the conclusion of an agreement among the Allied powers to pool all their merchant shipping, thus putting under one head an enormous fleet of approximately 18,000,000 tons deadweight capacity.

The pooled fleet will include close to 13,000,000 tons of British ships, 2,000,000 tons of American ships, 1,600,000 tons of French ships, and 1,250,000 tons of Italian ships. The object to be gained by pooling these ships is the realization of a more efficient and economic use of the aggregate freight carrying facilities of the Allies.

It has been estimated that the pooling of freight ships by the Allies would about offset the ship losses through submarine disasters during the last several months, enabling the nations concerned to begin next spring upon a merchant shipping footing equal nearly to that attained last year.

U.S. Idea.

The pooling agreement, it is understood, is one of the proposals which the American delegation to the Inter-Allied Conference will offer. Commissioner Colby, of the United States Shipping Board, it is reported, has been instructed to offer this suggestion on behalf of the United States. It will be one of the first tangible evidences of the London reports to the effect that the United States is anxious to go a long way toward concentrating the war forces against Germany.

While it is said that the leading Allied nations have approximately 18,000,000 tons deadweight of ships at their disposal, the Allied freight shipping pool would probably not have this much tonnage at its disposal. A number of these vessels must be retained by each Allied nation as transports and auxiliaries. This is especially true of the ships which must be used by the United States in carrying troops and supplies to Europe. The pooling agreement which is seriously under discussion will concern only the independent freight carrying trades, which, however, are already under regulation by each Government and which of necessity represent a vital part of the war, even though such trade is not directly related to the transportation of troops and army supplies.

The Shipping Board has made a survey of the shipping facilities of the world which shows that the world's tonnage, based upon figures deemed to be accurate two months ago, is about 48,000,000 tons deadweight. This includes 31,000,000 tons of overseas ships, 6,000,000 tons of inland and Baltic ships, 6,000,000 tons of coastwise only, and 5,000,000 tons of enemy ships.

CANADA'S SEA FISHERIES.

A REPORT on the results of sea-fishing operations in Canada for the six months from April to September, and also for the month of October, has been issued. It is stated that, in comparison with a similar period last year, the landings of cod and halibut on the Atlantic coast have increased by over half-a-million hundredweight. The herring catch for the six months this year, however, was far below that of last, amounting to only 645,844 cwts., as compared with 946,487 cwts. The quantity of salmon taken on the Atlantic coast during the season of 1917 was 1,578 cwts. short of the previous season's catch.

In spite of the fact that there was an extra month's fishing for lobsters along the southern part of the Gulf of St. Lawrence, this season's pack is short of last. Since the opening of the season on the 15th of November, 1916, until the end on the 10th of September, 1917, there were packed 181,227 cases, while 70,321 cwts. were used fresh or shipped in shell. The figures for the preceding year show 188,545 cases packed, and 94.409 cwts. used fresh or shipped in shell.

Particularly rough and unfavorable weather during October greatly interrupted fishing operations in the Atlantic, with the result that total landings of the chief kinds of fish were much below the figures of last year.

In the whole of the Atlantic provinces there were 153,640 cwts. of cod, haddock, hake and pollock landed during October this year, as against 242,580 cwts. a year ago.

The total value of sea fish landed in Eastern Canada during October was $736,567, as against $886,095 for October last year. The total value of the various kinds of sea fish at the point of landing on both coasts for the six-month period in 1917 was $19,325,547, as against $12,-493,143 for the same period in 1916.

SMOKE BOXES

THE Bureau of Ordnance of the Navy Department is having manufactured by the DuPont Co. smoke boxes suitable for use by merchant vessels as a means of escape from attacking submarines. Merchant vessels desiring to procure these smoke boxes can obtain them from the DuPont Co. The cost will be approximately as follows:

Smoke funnels	each	$125.00
Phosphorus	pound	1.75
Smoke boxes	each	25.00

The smoke funnel is for the production of smoke on board the vessel, and requires only the fuel for its continued use. The smoke boxes are for throwing overboard and once used can not be recovered.

The Navy Department is preparing to issue smoke boxes to all vessels carrying armed guards, and has announced as its policy that smoke-producing apparatus for the use of merchant vessels should be available for every vessel desiring to purchase same. It is urged that merchant vessels give prompt and favorable consideration to the desirableness of purchasing smoke-producing apparatus.

The War Instructions for merchant vessels of the United States, issued by the Navy Department, contain directions for the use of smoke-producing apparatus, and the Bureau of Ordnance of the Navy Department issues a pamphlet dealing with the particular type of smoke-producing apparatus manufactured by the DuPont Co.

OIL ENGINES DOUBLE SAILING SHIP VOYAGES

THE suggestion was made some time ago that all existing sailing ships should be fitted with oil engines, whereby the number of voyages made within a given time could be doubled. One objection to the above suggestion is that many of the vessels in question are old ships, which would not stand the vibration of the motors. This objection, says the *Motor Ship and Motor Boat*, is not supported by experience, many old sailing ships having been fitted with oil engines. For instance, a vessel built in 1883 (34 years ago), which was originally built as a tug, was afterward converted into a sea-going lighter, and is now a schooner with auxiliary power.

A still more striking instance is the brigantine Tyne, built in 1867, which has recently been fitted with two 50 horsepower hot-bulb engines. It is said that motors have been installed in wooden ships in which some of the timbers were half rotted through, yet they were put into service and gave satisfactory results. These examples effectually dispose of the objection that the vibration of the motors will prove disastrous. A much more reasonable objection at the present time is that auxiliaries, being slow compared with full-powered craft, while being visible from long distances, owing to their tall masts and sails, are an easy prey for German submarines. This drawback can, however, be overcome by sending such vessels to remote parts of the globe, where they can relieve full-powered ships for service in the danger zones.

In order to effect the conversion to auxilaries of existing sailing ships a certain proportion of the work on new full-powered vessels would no doubt have to be suspended, but this policy would be amply justified in view of the more rapid increase in the effective tonnage thereby brought about.

New High October Record.—The statistical report of traffic at the Soo canals for the month of October shows that a total of 12,646,066 tons was carried through the Canadian and American waterways, establishing a new high record for that month, despite the fact that freighters were receiving slow despatch the latter part of the month, due to frozen ore and shortage of cars. Vessel passages for the monts were 3,147.

Brass and Other Copper Alloys Used in Marine Engineering*

By L. T. Milton

In this paper it is intended only to deal with brass and other copper alloys in their different forms as they are used by the marine engineer, and it will be found that even with this restriction the subject covers a great deal of ground. The author is chief engineer surveyor of Lloyd's Registry. By virtue of his position he is therefore well qualified by experience to give an expression of opinion warranting close attention of all engaged on marine work.

THE first point to be mentioned is that of nomenclature, and this is found to be a very difficult matter. Marine engineers, as well as many others who use brass, bronze, and various alloys of copper and other metals, have very vague ideas as to names, calling all sorts of metals "brass" which are not true brass, and calling others "bronze" which are more nearly allied to brass than to bronze. In fact, we generally call parts of bearings "brasses" which are made of so-called gun-metal, phosphor bronze, or anything but brass. Even when they are made of cast steel or cast iron and lined with white metal they are often still called "brasses." Some of the white metals are sometimes called "bronzes."

The Terms Brass and Bronze

It has been recommended that the term "brass" should be restricted to alloys of copper and zinc only, but containing more copper than zinc, i.e., containing over 50 per cent. copper. An alloy containing a third metal is to be denoted with the name of the additional element used as a prefix. Thus the alloy containing 1 per cent. of tin, 29 per cent. of zinc, and 70 per cent. of copper used for Admiralty condenser tubes should be called "tin-brass." Similarly, the term "bronze" should be used to denote an alloy containing more than 50 per cent. of copper, the remainder being tin only. If other metals are present, then their names should be used as prefixes, thus the ordinary Admiralty mixture usually called "gun-metal," containing 88 per cent. of copper, 10 per cent. of tin, and 2 per cent. of zinc, should be called "zinc-bronze." It may be stated that these names have not yet come into general use, and both the terms "brass" and "bronze" are being frequently used in most misleading ways.

Even the name gun-metal conveys no precise idea, either of the composition of the metal or of what a gun is made of, as when copper alloys were used for making guns they were generally composed of copper and tin only; that is to say, they were "bronzes," whereas the term "gun-metal" is now more often employed to denote an alloy containing zinc in addition to copper and tin. Moreover, these guns were generally spoken of by the soldiers who used them as "brass" guns.

In this paper the alloys will be spoken of by the names usually employed, although they are admittedly not precise, but it is hoped that no misconception will arise through the use of these common names, as it is intended in all cases to state the main elements of their composition.

Copper-Tin Alloys

Copper-tin alloys were known and used in the remote past, in the so-called "bronze" age before the use of iron. It is stated that a rod of metal found by Dr. Flinders Petrie, at Meydum, was found to contain 89.8 per cent. of copper and 9.1 per cent. of tin. It was estimated to date from 3700 B.C. Objects of bronze were found at Troy, supposed to date from 1200 B.C. The first artificer we read of in the Bible was Tubalcain, who was an instructor of every artificer in brass and iron. In Hiorns' book on alloys there is a question from another work, in which it is stated that the word translated as "brass" in this and in other places in the Bible, probably refers to "bronze," an alloy of copper and tin. From Percy's Metallurgy, however, it is evident that real brass, i.e., an alloy of copper and zinc, was in use in Roman times. He gives the analyses of four ancient coins, all containing not less than 10 per cent. of zinc, of dates about 20 B.C., 60 A.D., 79 A.D., and 120 A.D., and also analyses of other ancient brass coins of somewhat later period; one of these has a composition which would be suitable for making condenser tubes. Percy states that although zinc was used in these ancient alloys, it was not known as a separate metal. He implies that it was not until the 16th century that zinc was so known, and that from the Roman times until then the brass alloy was made by what is known as the "calamine" process, a method which was in use in Great Britain so late as 1859.

Calamine

Calamine is a zinc ore consisting primarily of carbonate of zinc. In making brass 100 lbs. of calcined calamine was mixed with 40 lbs. of ground coal and a little water. This was then mixed with 66 lbs. of bean-shot copper and charged into crucibles which, in groups of nine, were placed in a furnace. The heat applied permitted the coal to combine with the oxygen of the ore. At a temperature somewhat below the melting point of copper the zinc which was reduced was vaporous and combined with the copper which, being in small pieces, presented a large surface to the action of the zinc vapor. The brass produced in this way has about the composition of 2 parts copper to 1 of zinc. "Calamine" brass was for a long time thought to be of superior quality to brass produced by the direct mixture of zinc and copper, which is the method of manufacture now always adopted.

Copper and Zinc Alloys—Brass

Copper and zinc alloy in all proportions, and the alloys throughout their range have been scientifically studied perhaps more than any other series of alloys. Law gives a table of no less than 144 records collated for the Committee on Alloys appointed by the United States Board (reported in 1881). G. Charpy, an eminent French metallurgist, in a volume upon alloys, published by the Societie Nationale d'Encouragement, Paris, has given a very complete account of the microstructure of these alloys. A. H. Hiorns in his book on "Metallic Alloys" gives a table of 54 different alloys mainly of copper zinc, but a few containing small quantities of other metals. He also gives a table of the freezing points of the alloys throughout the range, which table agrees with the curve given in the Fourth Report of the Alloys Research Committee of the Institute of Mechanical Engineers, which report deals with alloys of copper and zinc, and also those of copper and tin.

This report points out that the brass alloys which admit of industrial application are those containing from a minute proportion of zinc to 45 per cent. of that metal. When the proportion of zinc becomes as high as 50 per cent., the alloys become fragile. The report states that it is found that generally the limit of elasticity, the resistance to penetration, and the hardness increase with the proportion of zinc, the tenacity also increases until it attains a maximum at about 45 per cent. of zinc. The extensibility, compressibility, and reduction of sectional area increase with increase of zinc, but attain their maximum at about 30 per cent.

In alloying copper and zinc there is no doubt whatever that true chemical union takes place between the metals, but this can only occur in atomic proportions. The atomic weights of the two metals are nearly equal, being 63.2 for copper, and 65 for zinc. Various experimentees have considered that the compounds $Cu\,Zn$, $Cu\,Zn$, $Cu_3\,Zn_2$, $Cu_3\,Zn$, all may exist. In the tables of brass alloys quoted both by Hiorns and Law, compositions are given ringing by units right up to $Cu_{10}\,Zn$, and down to $Cu\,Zn_8$. What might fairly be considered is that the alloys containing the least proportion of zinc are composed of a compound of copper and zinc existing as a solid solution in copper, and that those containing more zinc as solid solutions of one zinc copper compound in another compound of different proportion.

Copper Zinc Alloy Structure

When copper zinc alloys are examined microscopically by suitably preparing

*From paper read before the Institute of Marine Engineers, the author being a vice-president.

and etching sections, it is found that all those containing from about 67 to 100 per cent. of copper have a uniform crystalline structure. Those of less copper content down to about 55 or 50 per cent. have a duplex structure; that is to say, they consist of two constituents, at about 50 per cent. one constituent only is present. The above refers to the metal, both in the annealed and also in the "hard-worked" condition. If, however, the metal is raised to a very high temperature and quenched, the duplex structure is found to have disappeared. Apparently the two constituents mutually dissolve into one another at a high temperature, and are retained as solid solutions by quenching. Slow cooling, however, permits them to again separate, and the slower the cooling the more complete is the separation which takes place. In the alloy named "Muntz metal," containing approximately 60 per cent. copper and 40 per cent. zinc, the separation is well marked.

Improved By Working

All the alloys containing 55 per cent. and above of copper have their useful properties considerably improved by working. Those below, about 66 per cent. of copper may be forged or rolled hot, Muntz metal being easily so worked; above 67 per cent. it is generally considered that the metals can only be worked cold. As the critical proportion, say 66 or 67 per cent., is approached, more care is required in forging hot. Muntz metal and the other low zinc alloys can also be worked cold as well as hot. In all cases of cold working every deformation given to the metal hardens it and renders it less able to withstand further deformation, but this hardness may be removed by annealing.

A remarkable example of how cold work can alter the shape of a mass of metal without producing fracture was given by Sir William Anderson in the discussion on the Fourth Report of the Alloys Research Committee, in an explanation of the manufacture of brass cartridge cases for 6-inch quick-firing guns. These are made from an alloy of 70 per cent. copper and 30 per cent. zinc. This is rolled cold into a plate from which circular discs are cut. The discs are then pressed cold into a cup shape, then annealed and cleaned. The cups are then gradually drawn out into close-ended tubes, thinner and thinner, each draw, except the last one, being followed by annealing and cleaning. In all, there are eight annealings, the whole of the work being done cold.

Marine Engineering Applications

The same alloy, 70 per cent. copper and 30 per cent. zinc, is also used for making condenser tubes, although sometimes a slightly higher percentage of zinc is used for this purpose, say up to 33 per cent., and similar metal is also sometimes used for cartridge cases. For the Admiralty, condenser tubes have a little tin added to the mixture, their standard proportions being 70 per cent. copper, 29 per cent. zinc, and 1 per cent. tin. In making condenser tubes the metal is first cast into tubes about 3½ inches external diameter, ½ inch thick. These tubes are then drawn down cold upon smooth mandrels several stages until they become of the finished size; each draw, with the exception of the last, is followed by annealing. The last draw leaves the tube "hard." The amount of "draw" or "pinch," or reduction of cross sectional area at the last operation is such as to leave the tube sufficiently hard to withstand the tendency to crush, owing to its being tightly packed in the tube plates, but not so hard as to be brittle.

As a surface defect on the inside of the original cast tube would not be entirely removed by the drawing process, it is usual to bore out the cast tube before any drawing takes place, and so produce a clean and good surface to start from. This, however, is not always done. The same alloy, viz., 70 per cent. copper and 30 per cent. zinc is used for making turbine blades. The process of making them, so far as the author is aware, has not been made public.

Condenser ferrules are made of an alloy containing a little more zinc than the condenser tubes. They are machined from tubes "hard" drawn, as for them hardness is a desirable quality, enabling them to be screwed up tight upon the packing without deformation.

The brass tube plates of condensers are usually made of "Muntz metal," i.e., an alloy of 60 per cent. copper and 40 per cent. zinc. For Admiralty work the mixture specified is 62 per cent. copper, 37 per cent. zinc, and 1 per cent. tin, and this metal is called naval brass. The tin is required, as it is thought that its presence assists in resisting corrosion. These plates are rolled hot.

Zinc and Alloy Strength

It has been stated that with these brass alloys greater strength is obtained with those containing a larger proportion of zinc. Many figures are given in different books of test results of the various brasses, their diversity is due partly to variations in the quantity of work put upon the metal, partly to the greater or less amount of annealing to which it has been subjected, and partly to the effect of impurities in the metal. Quoting the report on Alloys Research previously referred to, the alloy "with 40 per cent. of zinc elongates 40 per cent., with a strength of 23.8 tons per square inch. By adjusting the softening effect due to annealing and the strength produced by working, it is easy to increase the tenacity of bars and sheets to 38.09 tons per square inch, and to attain even greater strength in the case of wires."

In the same report there is a statement by Dr. D. Watson, the manager of the Broughton Copper Co., of Manchester, showing the effect of small quantities of impurities upon the strength and ductility of brass. He gives the following:—

	Tenacity per sq. inch tons	Elongation %
Brass containing 70% of copper and 30% of zinc......	20.2	65½
Same brass, with the addition of 0.5% of iron	24.2	31¼
Same brass with the addition of 0.5% of iron and 0.1% of phosphorous	26.5	28

The above samples were thoroughly worked, and afterwards annealed before testing. Dr. Watson stated that the effect of iron was very marked, and that aluminum manganese and tin also had influence in increasing the tenacity and elastic limit, although they decreased the elongation.

Cold Working and Annealing

It has been mentioned that when much cold work has to be put on brass, as, for instance, in the manufacture of cartridge cases, seamless tubes, etc., the brass has to be frequently annealed. The temperature at which this takes place is of great importance. Law quotes some information from Mons. G. Charpy, which shows that when brass of 70-30 composition has been worked to its maximum condition of strength of over 30 tons per square inch, the full effect of annealing is produced by a temperature of 600 degs. C., which reduces the strength (cold) to 17.4 tons per square inch. Annealing below 280 degs. C. has practically no effect; at 420 degs. C. there is a marked softening effect, but the maximum is reached at the temperature stated above.

Some information as to the increase of tenacity due to cold work and also as to the effect of annealing at different temperatures was given by Captain C. Grard, of Paris, in a paper read at the Congress of the International Association for Testing Materials, held in 1912, at New York. He dealt with copper and also with brass containing 90 per cent. copper, 10 per cent. zinc, and brass containing 67 per cent. copper, 33 per cent. zinc, the latter being an alloy used for the manufacture of cartridge cases by the French War Department. He states that the brasses experimented upon were of good quality, very malleable when cold, but fragile and short when hot.

He further states that the effect of cold working was the same, whether produced statically (drawing and rolling) or dynamically (under a drop hammer), and that the effect of cold work was completely removed by proper annealing. In making experiments with drastic amounts of cold rolling, recourse had to be had to successive cold rollings without intermediate reheatings.

Although valuable properties are given to these brass alloys by cold work, such as increase of strength and of elastic limit, it must not be forgotten that the ductility is much reduced at the same time. When brass is subjected to much cold work it is liable to spontaneous fracture. Cases are not unknown of condenser tubes spontaneously cracking longitudinally, and of cold-rolled brass rods being found split after being stored for some time. Such occurrences are sometimes called "season cracking." The cause is to some extent obscure, but the fact that it occurs shows how unwise it would be to rely upon what may be termed an artificial strength produced by cold rolling for articles in which a failure would cause disaster. This is sometimes not sufficiently realized by engineers, who think they are securing a better article by specifying stringent conditions of high tensile strength and high elastic

limit which can only be obtained by cold rolling.

Useful information on the effects of cold work upon metals is given in the May lecture of 1914 by Professor E. Heyn, of Berlin, delivered at a meeting of the Institute of Metals, in which he shows that the internal strains are set up by cold working affecting the metal near the surface differently to that nearer the centre of the piece. He mentions that cold rolling and cold hammering produce tension strains in the core of the worked pieces, whereas cold drawing has the contrary effect, bringing about tension strains on the superficial layers and compression in the core.

Brass such as has been considered above is mostly used by marine engineers in connection with condensers, or as bolts and nuts, and is never used in details exposed to high temperatures. At high temperatures its tenacity becomes considerably lowered. In the Alloy Research Committee's report already referred to a table is given, from which the following is extracted:

Temperature.	Tenacity Tons per sq. inch
20 degs. C. = 68 degs. F.	20.7
100 " = 212 "	13.6
200 " = 392 "	12.6
250 " = 482 "	10.4
300 " = 572 "	7.3
350 " = 662 "	6.8
450 " = 842 "	3.6
500 " = 932 "	2.8

Tenacity of brass of composition copper 61.2 per cent., zinc 38.8 per cent.

Spelter, or Hard Solder

Another alloy of copper and zinc used in marine engineering is known by the names of "Spelter," and also "Hard Solder." It is used for brazing purposes. (Note the name spelter is also used to denote ingot zinc, but brazing solder is generally termed "spelter" by coppersmiths and engineers). This alloy is composed of copper and zinc, varying from 60 per cent. copper, 40 per cent. zinc, to about equal proportions of each, according to the purpose for which it is to be used; the higher proportion of zinc in any solder lowers the temperature at which it melts. During fusion, in brazing some of the zinc evaporates, leaving the solder on the finished article richer in copper than the original alloy. Hard solder is always made on a granulated form, which is obtained by casting the alloy into flat ingots. These are heated to a high temperature, judged by the color, and at this temperature it is very brittle. It is then pounded up into small pieces in an iron mortar. The broken pieces are sifted out to various degrees of fineness; the large pieces, if any should remain, are then repeated and repounded.

Pure Metal Essential

In making brass alloys it is important to use as pure metals as possible for the constituents. It has been stated that iron has a very marked effect upon the strength and ductility. Lead is often present in small quantities, being generally introduced along with the zinc, as much of the commercial zinc contains lead. It is, however, considered to be of great importance that the metal should not contain either antimony or arsenic, both of which may be introduced along with the copper. There is a workshop test known as the Muntz Metal test, practised in order to detect these impurities if their presence is suspected, either in copper or brass. A weighed portion of the copper or brass to be tested is melted in a small crucible and sufficient pure zinc is added to bring the proportion of copper and zinc to 60/40, the composition of Muntz metal. The resulting metal is poured into an open cast-iron mould, the quantity being sufficient to make a flat cake about 1 inch in thickness. This is allowed to cool. When cold it is nicked across with a chisel and broken. If the metal is good the fracture is fine and silky, but if even small traces of arsenic or antimony are present the fracture is different. The skilled workmen can in this way determine the proportion of either of these pernicious elements with almost the same precision as can be obtained in a chemical laboratory.

Copper, Tin, Zinc Alloys—Bronzes

We will now consider the bronzes, i.e., alloys of copper and zinc.

Pure bronzes, i.e., alloys of copper and tin only, are not much used by marine engineers, as almost invariably some zinc is added to the alloys, which in their various forms are usually misnamed either "brass" or "gun-metal." These alloys are used as castings, no forging work, either cold or hot, being put upon them. The reasons for their use for many purposes are the facility with which they can be cast to the shape required, their comparative resistance to corrosive influences, and their strength.

The alloy known as Admiralty gun-metal is composed of 88 per cent. copper, 10 per cent. tin, and 2 per cent. zinc, and this is without any doubt a very useful alloy. All kinds of boiler mountings, such as gauge cocks, feed and blow out and scum valves and chests, and the valves and seats of stop and safety valves requiring a strong and incorrodible metal, are made of this alloy. Sometimes where a little harder metal is required to resist wear, such as in some valves and valve seats, water gauge cocks, etc., the zinc is omitted and pure bronze is employed of a composition of 90 copper and 10 tin.

The addition of the zinc serves a very useful purpose in rendering the casting sound, besides the influence it has on the strength of the metal. When copper is melted and exposed to the air it rapidly oxidises, and molten copper has the property of dissolving the copper oxide so formed. When a bronze is melted both the copper and tin composing it are oxidised. The tin oxide is not soluble in the molten metal, but the copper oxide is; the tin oxide formed, therefore, remains on the molten metal as a scum, but the copper oxide disappears by going into solution in the molten metal. During the solidification of the metal at least part of the oxide becomes thrown out of solution and separated, and the result is a multitude of minute particles of copper oxide dispersed through the metal, which in consequence is more or less porous and unsound. If, however, there is a small proportion of zinc present, this metal has a greater affinity for oxygen than copper, and the copper oxide becomes reduced to metallic copper, giving up its oxygen to form zinc oxide, which, not being soluble in the fluid metal, rises to the surface in the scum. A small addition of zinc, therefore, permits a sounder casting to be produced.

Phosphor Bronze

A similar result may be obtained by the addition of a small proportion of phosphorus, which, as is well known, has a very great affinity for oxygen. When this is added to a copper-tin alloy the result is termed a "phosphor bronze." The phosphorus is added either in the form of phosphor-copper or phosphortin. Phosphor-copper is commercially obtainable in two forms, one containing 15 per cent. of phosphorus, the other 10 per cent., the latter melting at a lower temperature than the former.

If the precise proportion of phosphorus necessary to remove the oxygen is added to the bronze, the metal remaining is still called "phosphor bronze," although it will contain no phosphorus, but its properties are considerably better than those of a bronze not deoxidised.

Zinc is often used in the so-called "gun-metals" employed in marine engineering in considerably greater proportions than the 2 per cent. specified in the Admiralty mixture. It is sometimes said that the greater proportions are used because zinc is cheaper than either copper or tin. Lead is also often added, but not always with the view of making a cheaper mixture, as reference to Mr. Dewrance's research, to be presently referred to, will show. The addition of lead renders the metal less tough, and, therefore, more easy to machine, and for this reason it is, to say the least, not objected to by the machinists. It is also claimed for certain admixtures of lead that they render the metal more suitable for bearing purposes, by reducing the friction under heavy loads, and, especially in America, alloys containing considearble quantities of lead are used for bearings in heavy mchinery.

Microscopic Structure of "Gun-Metal"

The microscopic structure of the so-called "gun-metal" used in marine engineering work is peculiar. When ordinary castings are being machined with a fairly rough cut the surface is seen to present a mosaic of ordinary yellow and of a rather lighter color. Each portion showing one color is a crystal with different orientation to its neighbors, and the crystals so shown are fairly large, their size depending upon the rate at which the casting cooled from its liquid condition. When a cut surface of the metal is carefully polished and suitably etched and examined under a microscope, it is seen that each of the above-

mentioned crystals is really composed of a number of "dendrites," arranged in regular geometrical fashion like the divisions of a fern leaf.

What happens in the cooling out of the metal is that the particles which first solidify are richer in copper than the average of the metal. They arrange themselves in a skeleton form of dendrites. Next to solidify are other particles not quite so rich in copper as the preceding, these arrange themselves outside those already formed, and the process goes on, the skeleton drendrites becoming more and more clothed with metal less and less rich in copper, and the portion of the metal which still remains fluid becomes relatively poorer in copper and richer in the tin or tin and zinc, until a point is reached at which it all becomes solid. The dendrites thus formed have been referred to by American metallographists as being of "onion" type, not because the shape is that of onions, but because it is formed of successive layers deposited on one another. Suitable etching of sections of the dendrites shows by the deeper colors of the centres that this difference of composition exists.

Where the copper is not more than about 91 per cent. of the composition the metal cannot well be worked either by hammer or by roll, either hot or cold. With greater proportion of copper than 91, especially when the metal has been deoxidized by phosphorus, some amount of work can be put upon it, and we have made in this way the so-called "phosphor bronze" rolled sheets which are used for air-pump valves, and which are hard and elastic. It is also drawn into wire for electrical purposes where high conductivity, combined with high strength and resistance to corrosion, are required.

Heat Treatment

In view of the peculiar onion-like, minute structure of gun-metal, it may be thought that it will be possible to modify its qualities by such heat treatment as will make the constituents diffuse into one another and become a homogeneous whole instead of remaining of diverse composition. Experiments in this direction were made by Messrs. H. S. Primrose and J. S. G. Primrose, and were communicated to the Institute of Metals in 1913. They experimented on metal cast in ordinary dry sand moulds, and also on samples cast in chill. Their tests included raising the metals to different high temperatures, keeping them at these temperatures for different lengths of time, and cooling some by quenching, and allowing others to cool out as in ordinary annealing. Their conclusions were:—

1—No improvement results from heating and quenching which lowers the strength of the material.

2—Simple annealing of the metals for thirty minutes very considerably increases its strength and elongation, the maximum results being obtained after annealing at 700 degs. C.

3—The homogeneity and other physical properties of the metal are correspondingly improved, but particularly the capability of the castings to withstand hydraulic pressure.

In the results quoted in the paper the unannealed dry sand casting had a tensile strength of 17.2 tons per square inch, and an extension of 24 per cent., whilst that which had been annealed for thirty minutes at 700 degs. C. had a tensile strength of 18 tons, and an extension of 37.5 per cent. With the "chilled" castings the improvement was still greater. It may be stated that the requirements of the Admiralty specification for gun-metal are a minimum tensile strength of 14 tons per square inch, and extension of at least 7½ per cent. in a length of 2 inches.

High Temperature Effects

Although "gun-metal" is extensively used for boiler fittings, and therefore exposed to temperatures as high as that of high pressure steam, very little information is available upon the strength and ductility of the metal. There has, however, long been an uneasy suspicion that high temperatures considerably depreciate its qualities.

John Dewrance in a paper communicated to the Institute of Metals, gives some valuable information on this subject, which shows that the suspicion was well founded. Good Admiralty mixture with a tensile strength of over 16 tons per square inch, and extension of 11 per cent. when cold retains its strength up to a temperature of 350 degs. F. (corresponding to a boiler pressure of 120 lbs. per square inch). At 375 degs. F. (corresponding to 170 lbs. pressure), its strength fell to 13.5 tons per square inch, whilst at 400 degs. F. (corresponding to 245 lbs.), its strength fell to 9.2 tons per square inch, and its extension fell to 1 per cent. At higher temperature the deterioration was still worse. Mr. Dewrance, however, found that the admixture of a little lead to the metal considerably improved matters. If the tin and zinc were retained at 10 and 2 per cent. respectively, and the copper was reduced by ½ per cent. and ½ per cent. of lead added, the extension when cold was a little lowered, but the tensile strength was not affected. At high temperatures, however, a great difference was found. No reduction of strength took place until a temperature of 550 degs. F. was exceeded, and the extension was continuously improved right up to this temperature. Mr. Dewrance made similar experiments with still larger proportions of lead. His conclusions were that ½ per cent. lead gave the best results, but even more than this still left the metal better at high temperature than that containing none.

Alloys Claiming Special Strength

Attention will now be directed to some of the alloys for which very special qualities of strength, etc., are claimed. They all are composed mainly of copper and zinc, and all or nearly all contain a proportion of iron, some of them contain one or more other components, such as tin, aluminum, manganese, or nickel. They are mainly proprietary articles, and their exact composition and the methods of making them are supposed to be trade secrets; their composition, however, can easily be determined by analysis. The fact that iron could be added to brass, and that its addition strengthened the alloy, has been known for very many years, and such metals have long been known under the names of "Sterro metal" and "Aich's metal." Law states that these two metals each contain 60 per cent. of copper, 38 per cent. of zinc, and 1.5 to 2 per cent. of iron, although the composition, so far as iron is concerned, varies within wide limits. This variation was due to the imperfect methods of introducing the iron.

Delta Metal

In 1883 Mr. Dick took out a patent for manufacturing an iron-brass, which he called "Delta" metal, by introducing the iron in the form of an alloy of iron and zinc, which could be obtained of reliable composition, other metals, however, were added. Law gives the average composition of Delta metal as copper 55 per cent., zinc 42 per cent., iron 1 to 2 per cent., with small quantities of manganese, aluminum, tin, and sometimes also lead.

Delta metal, like most of these iron-brasses, can be easily cast, and it is also capable of being rolled or drawn cold, and of being forged hot. It is also often "extruded." In this process, instead of being hot rolled from a billet, finished bars are made by forcing the highly-heated metal through dies by applying a great pressure by means of a hydraulic press. By such means bars of almost any desired cross section may be made, but it is not generally considered that the quality of bar so made is equal to that of bars of the same composition made by the ordinary rolling process. Extrusion may be applied to most of the alloys containing from 55 to, say, 60 per cent. copper.

Manganese Bronze

"Manganese bronze" is another of the alloys frequently used. It really ought not to be called bronze, but might, perhaps, claim to be called manganese-brass, although the amount of manganese in it is exceedingly small. This metal is used for castings, especially for propeller blades, and it is also forged when required and rolled into bars from which studs, bolts, valve spindles, etc., are made. It is made by several firms who all have their own ways of introducing the iron, the vital constituents, into it. The basis of the iron in the case of this metal is Ferro-manganese.

It has been stated that copper when melted dissolves copper oxide, which is an undesirable constituent. The manganese has great affinity for oxygen, and hence acts as a deoxydizer. It, therefore, sometimes happens that the whole of the manganese added in the ferro-manganese leaves the metal as manganese oxide, as, however, the iron remains in the metal the desired

strengthening quality is preserved. Ferro-manganese also contains carbon, which no doubt assists in the deoxydizing process. Some tin is usually added to the manganese bronze used for propeller blades, and often some aluminum as well.

Analysis shows that the iron is not always uniformly distributed through a large casting, the difference sometimes ranging to from 1.5 per cent. of iron to as much as 4 per cent., even when taken from contiguous parts of the casting. When a sample containing much iron is polished for microscopic examination minute hard spots are seen in it. These are thought by Mr. Dewrance and Arnold Philip, the Admiralty chemist at Portsmouth, to be particles of an iron in alloy, due to the iron alloying with the tin, and a greater proportion being present than can be kept in solid solution.

Many analyses of manganese bronze have been published, Law gives the following:

When so-called "bronze" propellers were first used it was found that the iron of the ships suffered from corrosion in their vicinity; if by chance the paint became injured, this was put down to galvanic action. This led to a different composition being used for the propellers. Now, more trouble appears to be met with in the corrosion of the propeller itself, and in some few cases very serious deterioration has occurred, especially in quick-running propellers, such as are used with turbine engines. To meet this, makers have in some cases again changed the mixtures, and "bronzes" are made which are claimed to be non-corrodible.

For yachts and small craft, which are built of wood and are copper sheathed, and in which iron or steel shafts are peculiarly liable to corrosion, forged "bronze" shafts of different sorts have been used, but it cannot be said with marked success, as all of the forgeable bronzes are copper-zinc alloys, and all

	Copper	Zinc	Tin	Lead	Manganese	Iron	Alum.
Cast	57.20	40.14	1.18	0.02	0.03	1.33	0.10
Rolled	62.45	36.00	0.63	0.06	0.02	0.84	....

It will be seen how little manganese there is in either of these alloys.

Law states that nickel is sometimes added to manganese bronze used for propellers, in order to prevent erosion. It is undoubtedly present in one alloy used largely for forging purposes, which, however, is not called manganese bronze by its maker.

The tensile strength and elongation of good rolled manganese bronze is about the same as those of ordinary mild steel. Like mild steel, when the bars are used for studs the material ought to be annealed in order to remove from it any possible effect of cold working. When bolts are made from it by forging, the heating in the process effectually removes this particular trouble, but if bolts are machined out from the solid bar, as they sometimes are, then the bars should be annealed, as in the case of studs.

Aluminum Bronze

Aluminum brass, or, as it is usually called, aluminum bronze, has sometimes been used for propellers. This is very similar to the manganese bronzes, and like them contains a small quantity of iron. The aluminum is added to replace a small part of the zinc, the copper contents not being much varied.

Cast manganese bronzes of the special types as made by various makers can be relied upon to have a tensile strength of from about 30 to 35 tons per square inch. They are, therefore, about as strong as cast steel, but they do not corrode so much as steel, and can be made with good surfaces. The influence of a smooth surface in improving the efficiency of propellers is now fully appreciated, especially in fast ships, and with high speeds of rotation. It need not be mentioned how much greater efficiency is claimed by makers of special propeller bronzes over ordinary iron or steel screws.

seem to be peculiarly liable to a form of deterioration to which the term "dezincification" has been applied. Copper-tin alloys would probably be more durable, but they do not possess the strength of the copper-zinc alloys. It is with the view of preventing, or, at least, retarding this dezincification that the Admiralty require at least 1 per cent. of tin to be added to condenser tube metal, and to all brass exposed to the action of sea water. The question of the best metal for making screw shafts for wood vessels will soon be raised in view of the decision to build a large number of wood steamers in the United States.

LIGNUM VITAE

THE lignum vitae of commerce, which is so extensively used in the stern bushings of ships for the bearings of the propeller shafts, ship pulleys, etc., is most suitable for this purpose owing to the highly desirable qualities that it possesses. This wood is obtained from the guaiacum tree, and its growth is almost confined to the isles of the West Indies and the northern coast of North America. The wood is of a yellow color merging into green, and has an almost pulverulent fracture owing to the peculiar characteristics of the fibrous layers, which are of a combined diagonal and oblique arrangement. On a transverse section the annual growth is very slightly marked in concentric rings, and it is only with the aid of a magnifying glass that traces of the pith, or spongy section is apparent; the medullary rays are equidistant, minute and very numerous. The outer wood, the sap-wood or alburnum, is of a pale yellow hue and devoid of resin; the inner heart-wood or duramen, which is by far the greater proportion, is of a dark greenish brown, containing about 26 per cent. of resin, and has a specific gravity of 1.333, and therefore sinks in water on which the sap-wood floats. The high specific gravity denotes hardness and density, and the fact that it is impossible to split it, makes it very durable and serviceable where great pressure and friction are required. In addition to its extensive use in engineering practice, this wood is possessed of high medicinal qualities, and in past times was, and even yet is, largely used in the compilation of drugs and chemicals.

STEEL FREIGHTERS FOR THE BRITISH GOVERNMENT

THE steel cargo steamers which the Canadian Allis-Chalmers will build for the British Government at Bridgeburg will have a capacity of 3,500 tons each. They will be 261 feet long over-all, 43 ft. 6 in. breadth moulded and 23-foot depth moulded, of steel construction throughout, and are to class 100 A1 with British Lloyd's Register of Shipping. They will be of the usual bulk-cargo type, but with special features adapting them for use during the present war-time conditions, being provided with appliances to protect the vessels against submarine attacks, in addition to being arranged with a view to evade visibility and identification. The steel entering into the construction of these steamers will be furnished by the British Government through the Cunard Steamship Co., and it is understood that a considerable tonnage of this steel will be available for delivery this year, enabling the builders to start operations immediately.

The propelling machinery will be constructed at the Davenport Works, Toronto. The main engine will be of the triple expansion type, the size being 20 in., 33 in., and 54 in. by 40-in. stroke and of the surface condensing type. The boilers will be two in number, 14 feet diameter and 12 feet long, constructed for a working pressure of 180 pounds. They will be fitted, for economical working, with the Howden forced draught system.

The coal bunkers will be located under the bridge deck and in the wings of the boiler space and will hold over five hundred tons.

The cargo holds will be three in number: Nos. 1 and 2 holds to have one cargo hatch each and the No. 3 hold abaft the engine room being provided with two cargo hatches. Each cargo hatch will be served by two independent cargo derrick booms, each of five tons capacity, and each boom with its independent cargo winch. The steam steering engine will be located on the upper deck in a special house abaft of the engine casing. The life-saving equipment will include two 26-foot lifeboats and one 18-foot working boat. The water ballast tanks, 3 feet deep amidships, will extend the entire length from the collision bulkhead forward to the peak tank aft. The accommodations throughout the ship will be steam-heated and the lighting throughout will be by electricity.

EDITORIAL CORRESPONDENCE

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THE NAUTICAL MILE

By R. Hamilton.

HOW often do we hear the expression "knots per hour" when reference is made to the speed of a vessel? This phrase, while not entirely erroneous, is nevertheless misleading, as the uninitiated are inclined to infer that a corresponding speed on land would be expressed as miles per hour. In reality, the values of the land and the sea mile are widely different, that of the latter being approximately 1/6 greater than the former; the relative distances being 5280 feet and 6080 feet. The speed of a vessel is indicated in nautical miles per hour, or simply so many knots. To make this meaning more clear it might be well to briefly define the origin of the term.

During the primitive days of ocean navigation it is doubtful if much consideration was given to the speeds of such vessels as then existed, but before the adoption of the "continuous log"—the recognized instrument for calculating ship speeds of the present day—it was customary for sailors to ascertain the vessel's velocity by means of the "common log." Its employment depends on the fact that a piece of wood attached to a line is thrown overboard (casting the log), to lie like a log in a fixed position, motionless, the ship's speed being calculated by observing what length of line ran out in a given time.

Ship's Speed by Common Log

To ascertain the ship's speed by the common log, four articles are necessary—a log-ship or log-chip, log-reel, log-line, and log-glass. The log-ship is a wooden quadrant ½ inch thick, with a radius of 5 or 6 inches, the arc of which is weighted with lead to keep it in a vertical position, and thus retard its passage through the water. Two holes are made near its lower angles. One end of a short piece of thin line is passed through one of these holes, and knotted, while the other end has spliced to it a hard bone peg, which is inserted in the other hole. The holes are so placed that the log-ship will hang square from the span thus formed. The log-line is secured to this span and consists of two parts. The portion nearest the log-ship is known as the "stray line"; its length varies from 10 to 20 fathoms, but should be sufficient to insure that the log-ship shall be outside the disturbing element of the ship's wake. The point where it joins the other part is marked by a piece of bunting, and the line from this juncture towards its other end is marked at known intervals with "knots," which consist of pieces of cord worked in between its strands.

A mean degree of the meridian being assumed to be 69.09 statute miles of 5280 feet, the nautical mile (1/60 degree) is taken as 6080 feet, which is a sufficient close approximation for all practical purposes, and the distances between the knots on the line are made to bear the same relation to 6080 feet as 28 seconds to an hour (3600 seconds); that is, they are placed at intervals of 47 feet 3 inches.

The end of the first interval of this length—counting from the piece of buting—is marked by a bit of leather, the second by a cord with two knots, the third with three knots, and so on; the middle of each section (half knots) being marked with a cord with one knot. Suppose eight knots of the line runs out in 28 seconds, the vessel has gone 5 x 47¼ feet in that time, or is travelling at the rate of 5 x 6080 feet (five nautical miles) an hour; hence the common use of the term "knots," as equivalent to nautical miles per hour. In the log-glass the time is measured by runing sand, which however, is apt to be affected by the humidity of the atmosphere.

Some practice is made of the 30-second glass, in which case the intervals between the knots on the log-line are made 50 feet 7 inches instead of 47 feet 3 inches. For speeds over six knots, a 14-second glass is employed, and the speed indicated by the log-line is doubled. In preparing a new log-line it is first well soaked, stretched and marked with knots, and wound uniformly on the log-reel, to which the inner end of the line is securely fastened.

"Heaving the Log"

To "heave the log," a man holds the log-reel over his head (at high speeds the man and portable reel are superseded by a fixed reel and a winch fitted with a brake), and the officer places the peg in the log-ship, which he then throws clear and to windward of the ship, allowing the line to run out freely. When the bunting at the end of the stray line passes his hand the officer calls to his assistant to turn the glass and permit the line to pay out freely.

When all the sand has run out, the assistant calls "stop" when the log-line is quickly nipped, the knots counted and the intermediate portion estimated. The strain on the log-ship, when the line is nipped, causes the peg to be withdrawn from it, and the log-ship is readily hauled in. In a steam vessel running at high speed on an ocean route, with engines working smoothly and uniformly, a careful officer with correct line and glass, can obtain very accurate results with the common log.

ENGINE ROOM UPKEEP PROBLEMS

By J. M.

IN the general attempt to keep down engine room expenses, there has been considerable temptation to engineers to, for some purposes, save their higher priced packings and use lower priced materials of a different kind instead. In the lower pressures this is quite feasible so far as packing for flanges, cylinder heads, low pressure pumps are concerned, but for piston rods, mudports and manholes, I, for one, do not favor this low-priced material.

Incidentally, I might mention an instance that came to my notice some years ago, where the use of unsuitable materials as a substitute for the "dollar a pound" patent piston packing formerly used resulted in so cutting and scoring the rod and in producing undue friction as to many times more than offset the difference in cost of material used. The loss was really due to the new supply of proper packing not being on hand until some time after the old supply had been exhausted, rather than by intentional experiment on the part of the attendant.

Low Pressure Engines

Speaking first of plants using, say, 80 pounds and under. In one of these equipments the only packing that has been used on the cylinder heads during the last few years has been candle wicking, bought then at ten cents per ball. The method of procedure is: Remove the cylinder head and around the portion of it which normally projects into the cylinder, wind two laps of the wicking close together and close to the shoulder, then wind a third lap on top of these two, taking care not to wind it so tight as to spread the first two laps, thus drawing the third one down between them.

The wicking is cut long enough that one end can be passed out through one bolt hole of the cover and the other end carried so as to give a little more than the exact three laps and then pass-out through another bolt hole. This holds the ends in position while the head is being returned to place. The threads of the bolts, if they touch the wicking are more inclined to abrade it than to pull it out of place. When drawn up tight this packing does not take up much space and therefore does not materially increase the clearance space. As stated before, it is O.K. for pressures of 80 lbs. or less. This method has been used successfully on an engine fed from a boiler carrying over a hundred pounds pressure.

For flanges and covers of rectangular steamchests, I have found asbestos board

both cheap and serviceable. Sheets one-sixteenth of an inch thick are suitable if the joint surfaces are smooth, but pitted or corroded joints may require two ply of this, or one ply of eighth inch board.

Asbestos Yarn

Asbestos yarn is another material in considerable favor by some engineers. My first acquaintance with this kink was when calling on a friend some years ago. He told me he had packed the steam-chest cover just a few days before and used only asbestos yarn, putting one lap around inside (I think he said inside) of the bolts, and afterwards winding a short piece around each bolt. He used one piece to each bolt and each piece around its bolt once. There was no sign of a leak at the time of my visit, and if I remember rightly, he was carrying something over a hundred pounds pressure on his boiler. The outfit was a comparatively small one, but the said steamchest cover would measure at least 15 x 20 in., and I think 18 x 24 is more nearly its real dimension, consequently the saving in sheet packing was noticeable.

My next experience came about seven years ago. I went over to the machine shop to get a couple of stud bolts made and meanwhile the engineer in charge packed one of the steamchest covers with the asbestos yarn, placing it inside the bolts and lapping the bolts with short pieces as mentioned above. The pressure carried on the boiler was 110 lbs. That joint gave no further trouble that season, and I have questioned the men in charge since, and so far have not learned of that particular joint having ever been packed since. The outfit, however, seldom ran more than six or seven months in each year. After seeing these two successful applications of the scheme I tried asbestos yarn myself, but prefer the asbestos board instead, as I generally find it more easy to hold in place while putting the joint together again.

Tallowed Candle Wick

I have known both tallowed candle wicking and asbestos yarn to be recommended for packing valve stems. I have tried both. Once with each was enough for me. The one was too hard, and the other wore too quickly. I have tried hemp packing for these and like it better, though I would advocate it because of its cheapness rather than because of exceptional virtues for the purpose mentioned. I use oil on it, as this is more convenient than tallow, and, according to my experience, less apt to produce verdigris. One man got fifteen cents worth of this some eight or more years ago. He has been back and forth between two plants using engines 10 x 12 and 11 x 16 respectively, and using from this for the globe valves in both plants. Last autumn he had a little of it left yet.

So far as small outlay for packing is concerned, I believe that the said candle wicking, asbestos yarn or asbestos board and the hemp packing provide an easy means to that end, so far as the cylinder heads, steam-chest covers, pipe flanges and globe valves are concerned. I also believe these to be both feasible and satisfactory in plants working at eighty or less lbs. per sq. in. I know that they can also be used for pressures up to 120 lbs., but let us consider another feature in connection therewith.

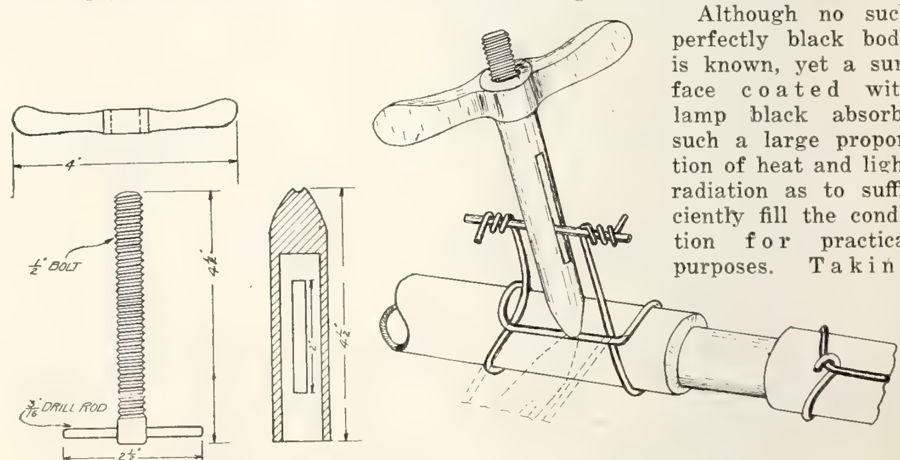
When using those "gol darned patent packings at one or two dollars a pound," we can put the nuts up to a reasonable strain, then after turning on just a little steam for a while and getting the iron heated through, we can tighten up some more, until finally we have a tight and reliable joint without unduly straining the bolts. On the other hand, if we use low priced, less pliable materials, we must perforce put a greater strain on the bolts to make the material imbed itself into any irregularities in the metal surfaces and in order to hold it in place against the pressure of the steam.

This excessive strain, on the bolts means ultimate premature stripping of the threads, and this in turn means either increased depreciation or increased repair costs, whichever way you prefer to figure it. This may easily overbalance any first cost saving made by using the cheaper material in plants using these higher degrees of pressure. It is in heating plants and in those power plants which have had the working pressure materially reduced owing to the advent of the new boiler laws that candle wicking, asbestos and hemp, can perhaps be used to advantage.

WIRE CLAMP MACHINE

By Sam E. Burd.

OWING to the large number of hoses in use at our plant, I devised the machine shown in the sketch to save time and clamps, and I find it will hold nipples, etc., better or as good as bought clamps, and it is a lot faster.



DETAILS AND ARRANGEMENT OF WIRE CLAMPING DEVICE.

I use annealed wire ⅛ in. in diameter, wrap it about the joint as shown, set the nose of the tool against the wire as shown, wind the loose ends around the pin and screw up tail nut. When tight, throw machine so as to make a hitch on the wire and cut.

WHITE PAINTED PIPE COVERING VS. BLACK

By A. H. W.

THE consulting engineer of the plant of which I have charge tells me that by painting the pipe covering dark I lose a great deal more heat than I would had I left them white. He also says that stove pipes which have been painted white will not let any heat out in the room, whereas, if they are painted black, they will let out considerable heat.

An explanation of these points will be much appreciated by the writer.

The fact that a perfectly black body will absorb more heat than a lighter colored body must be accepted as a phenomenon which we cannot definitely explain. We unconsciously apply this knowledge in everyday life by donning light colored apparel for summer rather than dark, the better to shed the heat of the sun's rays.

This relation between the heat absorbing power of a body and its power to reflect light is accounted for by considering both light and heat as a form of radiant energy, differing in the way in which they affect our physical senses. We see a body by reason of light reflected from that body to the eye. Were it possible to find a body which would absorb all light and reflect none, it would appear perfectly black. Again, we are sensible to the heat of a body by reason of heat reflected from the body. A perfect absorber of heat would reflect no heat radiation.

It so happens that bodies which have the properties of absorbing light most readily are also the best absorbers of heat so that a perfectly black body has the highest heat absorbing power. Conversely those bodies which are the best reflectors of light have the least heat absorbing power. The same applying relatively to all intermediate conditions between light and darkness.

Although no such perfectly black body is known, yet a surface coated with lamp black absorbs such a large proportion of heat and light radiation as to sufficiently fill the condition for practical purposes. Taking the heat absorbing power of lamp black as 100%, it has been found experimentally that the relative heat absorbing power of white lead is about 20%, with that of burnished silver the lowest at 7%. It would be interesting in this connection to know the value for aluminum paint which is sometimes used on stove pipes, but no figures for this

are available as far as we are aware.

However, this should answer your query as to the possibility of preventing in some degree the loss of heat by painting the radiating surfaces white, though the ideal condition referred to in your letter will hardly be attained.

THE CALL OF THE SEA

By Capt. Geo. S. Laing

"ANOTHER Yarmouth trawler gone, and only two saved out of a crew of ten."

Thus spoke the wife of a brave fisherman whose chance of being murdered without getting a whack at his adversary was growing more imminent as the days went by.

From Wick to Dover the Huns have waged a most ruthless piracy amongst our peaceful fishermen in absolute contradiction to all The Hague laws that were supposed to govern naval procedure.

"Jack, why not quit fishing and join the fighting fleet? You would then be able to understand your true position and expect to give as well as take when the fiends bore down on your craft."

"Wifie, I know you suffer more than your share and spend sleepless nights when I am afloat, but its my highest duty to stick to trawling. I was raised to this rough life from an orphan boy, and its hard paths have made me a hard creature. No German Kaiser or any of his savage clique will scare me from Dogger Bank."

In a further parley Jack reminded his anxious wife that our King and Premier had announced to the entire mercantile marine that the best fighting service that any seaman could give to his country was to stick to his particular craft, be she collier, fisherman or tramp steamer. Failure to do this would only cause the unseamanlike bullies to gloat over their nefarious actions as an untutored savage in Patagonia might be expected to do in his opaque reasoning.

As a nation we have great cause for thankfulness to know that no branch of the mercantile marine has given up its limpet determination to prosecute its particular vocation on the seas. All the manly traditions that Neptune imbues each wave with have been insulted beyond comprehension by the Kiel and Brunsbuttel sailors: yet trawlers go to the Banks, steam tramps are headed on all thirty-two points of the compass, colliers crawl up and down the coasts, passenger craft come and go. No sir, the subaqueous maggot known as the submarine will never squeeze the tar and salt out of John Bull's sailors. I doubt very much if a hundred years will bring back the esprit de corps amongst British and German seamen that has been disrupted by the ghoulish and unseamanlike use of torpedoes.

Some folks talk of banishing the anti-Christ man to St. Helena. What has that tropical ocean gem done that it should have to act as domicile for such a bloated impostor and ravager? As one who has beautiful remembrances of the historical island that is fanned by the S.E. trade winds, may such men as the Kaiser never set eyes on it. To digress more would spoil our story, so let us get back to Jack, the fisherman.

He had arrived in Yarmouth and the catch had brought a good sum of money. The submarines had been behaving worse than ever, no quarter for even neutrals or hospital ships. Chinese pirates must hereafter be rated as nautical angels, for the Hun holds for all time to come the butcher block of marine tragedies. Jack Lee was made skipper of a carrier and nothing could hold him back if the whole contents of the Kiel canal had been dumped down close to the Cockle Gat, which is almost within hail of the beach.

The fish carriers are very fast little craft that run into the main fishing harbors with the finny denizens that have been transferred to them on the Banks from the real trawlers. They have double the speed of the ordinary craft and to have charge of one is an appreciation in itself. Skipper Lee was given a lecture on the importance of making time in his new post by the vessel owner, this person emphasizing the value of minutes and seconds when express trains carried the fish to London markets.

Jack Lee had said good-bye again to his anxious wife and thrown his wee boy and girl in the air with the sportiness of a proud father. Under cover of night the carrier "Flying Fish" swung head down from Gorleston wharf and steamed away from the twin fishing ports. As she passed out of the river into the North Sea Jack Lee murmured something under his breath that sounded like this:—"Lord keep us safe from fanatic enemies, Thy elements of wind and sea we bow to as a part of a wise universal decree, but spare us, oh spare us from the sea murderers for we have no means of retaliation and are therefore helpless."

As the "Flying Fish" steamed out with her head between the Cockle and the Cross Sand light-ships, a danger signal in Morse light form was flung on the dark waters. Jack Lee had most of the attraction signals in his head and interpreted the long and short flashes to mean "come alongside, wish to communicate further." The first precaution was to stop the carrier's dynamo that generated the lighting of the vessel. All glass ports and companions and engine room skylights had been canvas-covered and the tiny craft stole along at reduced speed till a stop was made within hail of the light-vessel.

After finding out from the light-ship crew that a sailing ship and a cargo steamer had been sunk before sundown by enemy submarines, with an aggregate loss of twenty lives, among whom was a captain's wife and baby, Jack Lee was quite overwhelmed with responsibility and allowed his craft to drift with the tide. Calling his crew together for a confab to feel out their moral courage Jack's spirits were tempted to rise again on hearing the summing up of the men which really amounted to:—"Do your best skipper, we are as one with you, our vessel has fourteen miles an hour to her credit, and you are known to have fair judgment in manoeuvres."

"If that's the way you feel, men, we'll get further off shore, those who are off watch can lie down like troopers' horses and the rest of us stick to our posts of vigil." All night long the "Flying Fish" shook the waves from her heavily flared bows and skipper and wheelsman barely exchanged a word. The engineer and fireman below the water line were also high-strung and non-communicative.

At the first break of dawn, and when a mist peculiar to the North Sea in winter seemed to enshroud the vessel, Jack felt almost uncanny and simultaneously a rift in the waters could be detected. Brushing the faithful steersman aside, our skipper made use of a few marine adjectives and growled out "they will never take me alive." With this on his lips he jammed the rudder across his craft's stern and before the pirate could understand such audacity the "Flying Fish" had broken through the submarine's plates and fouled her own propellor in the attack.

In the melee the skipper had been beside himself but noticed now for the first time that the wheelsman lay in a swoon at his feet. As all danger was over and the enemy craft now acted as her crew's coffin under the wild waters, immediate attention was given to the sick man.

After first aid was rendered the poor chap began to come round and suddenly surprised everyone by asking if he was mortally wounded. Compressed fear that had held the fishermen in a tongue-tied condition found a vent of reaction at this astounding query, and jokingly the swooned man was asked by whom was he shot. Jack Lee knelt down beside his wheelsman and said in a trembling voice, "you're not shot at all, it was my fist, but I never meant to hurt you." "But didn't we sight an enemy submarine?" asked the man, "yes mate, but she is gone where she belongs to."

"Listen, listen! There's some one crying in distress."

"Where away?"

"Astern sir, look! it's a small life-boat full of people."

"Don't move the engines, they can row alongside, get ready to receive them." The presence of women and children at once stamped the Hun seamanship to another murder of innocents.

"Can you take us on board, we were torpedoed two hours ago?"

"Perhaps the Lord saved us to save you, for your murderer lies on the bottom of the sea, and this craft, the 'Flying Fish,' put him there."

"Engineer, no fish this trip, we will run back to Yarmouth with this precious cargo of human lives."

Then with three blades on her wheel

the carrier made ten miles an hour and reached port safely.

After recognition from the saved passengers in the shape of verbal blessings from tear-stained women and children and hand shakes from never to be forgotten men, Jack Lee and his modest crew felt that they had been handsomely paid. The trawler owner as well as the Government presented a tangible appreciation in gold to the saviours, but the finest words—every one a sparkling jewel—that went right to Jack Lee's heart came from the lips of his own wife. "Thank God you never listened to me Jack."

VESSEL SALVAGE—STERN STRUGGLE WITH SEA

THE work of salvaging ships may be divided into two classes. One consists in bringing home vessels which have become derelict or unmanageable, and the other in raising wrecks. Both are remunerative if the work is successful, and both have their great perils, especially the former. Nevertheless, it is the thing seamen largely live for. They show magnificent courage in saving life and property; their sporting instincts are aroused, and they have the chance of making big money, says the Glasgow *Weekly Herald*.

Some time ago the shipping world was thrilled by the story of the salving of the ocean-going tug Valiant by three members of her crew, after the vessel had been abandoned and given up for lost by her master and the remainder of the hands. The vessel, of 156 tons, met with exceptionally heavy weather during a voyage across the Atlantic, and was nearly at the end of her coal supply. A Holland-American liner, attracted by S.O.S. signals came up south-west of Ireland, and as it seemed certain that the tug could not last long, the captain and crew, who had been working in lifebelts, so serious was the situation, were taken on the liner. Only the second mate, and two hands, who volunteered at his request, stayed aboard.

Then ensued a fearful fight. The tug, practically at the mercy of the wind and waves, was bounced about like a cork. Vessels sent in search of her could render no aid, but the gallant three stuck to their work, and, after hairbreadth escapes, managed to make a port. The vessel was worth $100,000, and the president in the Admiralty Court, in awarding the second mate $12,500 and the other men $6,250 apiece, as salvage remuneration, said the courage, fine spirit, and absence of fear displayed by the men commanded unstinted admiration.

A Battle With the Sea

When the Cambrian, a Leyland steamer of 5,600 tons, broke her shaft in a storm in December, 1907, the position seemed well-nigh hopeless. Signals of distress were sent up, and these were seen by the crew of the William Cliff, a liner belonging to the same owners, and a vessel which, by the way, had taken a prominent share in the rescue of the Etruria, the famous Cunarder which, losing her propeller and rudder in mid-Atlantic five years earlier, was towed by the William Cliff to the Azores.

Well, on this occasion, the William Cliff went to give assistance to the Cambrian. Despite the terrible seas, a boat was launched to carry a line to the helpless. Thus was a heavy hawser attached, and the long and arduous tow began. It was determined to make for Crookhaven, a thousand miles away—a truly terrific task in a storm which, unfortunately, increased instead of dying down. Four times during that awful twelve days the hawser parted, and so bad was the weather that the only way in which connection between the two vessels could be re-established was by so manoeuvring the William Cliff that lines attached to lifebuoys could be floated to the Cambrian. One night the William Cliff and her convoy were unable to make any headway at all against the storm, and during one day the distance covered was but thirty miles.

Somewhat similar was a case reported in the early months of 1915, a case which led Sir Samuel Evans, President of the Admiralty Division, to say that the circumstances made one feel proud of our sailors. The story concerned yet another Leyland liner, the Asian, which in December, 1914, picked up the 6,000-ton oil-tanker Pinna 450 miles off Queenstown. For a fortnight the Pinna had been drifting without a propeller, and was short of food. It was another case of heavy towing in a storm, with the big hawsers breaking time and time again during the seven days in which the Asian stuck grimly to her job. Later, other vessels came to the rescue, or, as was pointed out in the Salvage Court, the work of the Asian, all the courage shown and all the risks and perils encountered, might have gone for naught. The salved vessel and cargo were claimed to be of the value of $500,000, and of $45,000 awarded in salvage to three vessels, $31.000 went to the owners of the Asian. $4.000 to her master, and $5,600 to the crew.

Gallant But Unsuccessful

A piece of work which turned out to be unsuccessful is still well worth including among stories of salvage feats. It was an episode in the life of one of the most famous tugs belonging to the Mersey—the Blazer. Some years ago the timber ship Nemea had to be abandoned some 200 miles from the Fastnet, and in order to prevent her from becoming a menace to navigation in a well-patronized sea-way the crew set her on fire. The steamer Vedamore brought the crew and their story to Liverpool. Their story inspired the manager of the firm owning the Blazer with the idea of salving the Nemea, providing she were still afloat, and he despatched the Blazer in search of a prize which might easily be worth $250,000. From the south coast of Ireland, the first call, the Blazer took up the scent, and in a day and night found the Nemea burning fiercely in the storm. Smoothing the water with oil, the men of the tug made a passage in a small boat, boarded the Nemea aft, and pulled in a line thrown by means of a gun from the Blazer, a 16-in. hawser being thus brought across and fastened to the burning ship. Forward the Nemea was a mass of flames. The bridge cabins, and forecastle head had gone, the plating of the hull from the bridge forward was buckled and in places red-hot, and over all were great clouds of steam which arose as the waves broke over the vessel.

Could she be brought to port, lower and lower as she was sinking in the increasing storm? It was a case of nil desperandum. The Nemea was towed stern first for two days, and never for a moment did the man on guard in the stern of the Blazer relax his vigilance lest the timber ship should suddenly sink and pull the Blazer down with her. He had an axe to provide against such a catastrophe. And at last he had to use it, for the Nemea became practically awash, only a bulkhead and what remained of her cargo keeping her afloat. It was hard luck, but a gallant effort.

Wreck-Raising

One or two cases of the other kind—wreck-raising—may be cited. The White Star liner Suevic figured in one of the most notable salvage cases on record. The vessel ran on the rocks off the Lizard in March, some years ago, and there were remarkable scenes, which will long be remembered in that part of the world, in connection with the landing of passengers and the floating of some of the cargo. But more interesting still, in one way, was the salving of the greater portion of the big vessel herself. She was badly injured forward, and therefore the bow portion was blown away by explosives after the main and after part had been rendered water-tight. That uninjured portion floated, and, patched up as well as possible, was towed stern first to Southampton. There she lay until a new nose, so to speak, was built at Belfast. This in due course was fitted on, after a tow which, in bad weather, was a fine feat of seamanship, and the Suevic was thus made as good as ever.

The case of the Milwaukee was somewhat similar. This was a vessel of over 7,000 tons, and she ran on rocks off the east coast, badly damaging her forepart; but the after end which contained the machinery, was in good condition. Could anything be done to salve the uninjured part of the vessel? The Liverpool Salvage Association answered in the affirmative, and set to work accordingly. It was decided to cut the vessel in two. Bulkheads immediately behind the smashed portion of the ship were strengthened in view of the fact that they were to form the temporary bow of the vessel, and then charges of dynamite in rubber tubes were placed all round the vessel where the severance was to be made. These were duly exploded, and the larger and more valuable section of the ship was thus afloat off the rocks, taken to Newcastle, and there placed in dry dock. A new nose was in due course built on, and afterwards the Milwaukee had a highly successful career.

Steam Saving Auxiliaries of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that steam-saving auxiliaries aboard ship continue to increase in number, and that they are being designed and constructed to meet, in the most effective manner, both ordinary and special service applications, this series of articles describing and illustrating at least the more important types of such apparatus seems to us more or less timely, both from the point of view of familiarizing engine and boiler room staffs with the products of different manufacturers, and that of their acquiring a closer intimacy with specific detail arrangement, relative to operation, maintenance and periodic overhaul.

STEAM SEPARATORS.—II.

WHERE boiler plants are operated without proper attention to water level, or where bad water and overloads are unavoidable, large amounts of water are constantly being passed into the steam main forming what are termed "slugs" of water which cannot be separated by ordinary separators which deal almost entirely with entrained or suspended moisture. The removal of these slugs is necessary if damage to the plant is to be avoided, and the receiver separator which has been developed to cope with these conditions. Some of these devices consist of regular type separators provided with additional receiving capacity, while others are specially constructed with a view to providing ample capacity as a feature of the design.

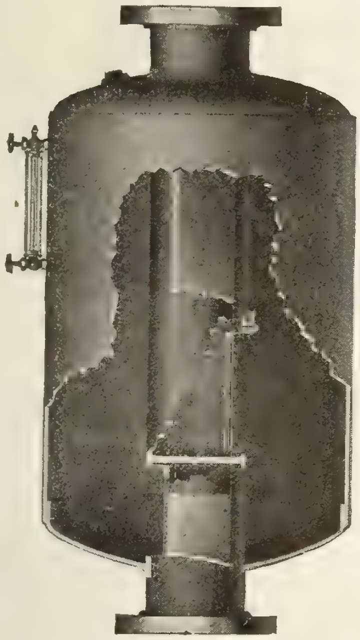


FIG. 11—VERTICAL "WELDERON" RECEIVER SEPARATOR WITH INTEGRAL PIPE EXTENDING THROUGHOUT.

Welderon Receiver Separator

Two types of this separator are illustrated, the vertical in Fig. 11 and the horizontal in Fig. 12. They consist essentially of a part of the main steam header, provided with a diaphragm and with inlet and outlet ports, and surrounded by a steel plate body or receiver. This construction is adopted to avoid any reduction in the strength of the steam main, which is carried without break from boiler to prime mover, thus completely eliminating any localization of expansion or contraction stresses, or any shock load due to vibration. Inside the receiver body, the continuous pipe is divided into two distinct portions by a steam-tight diaphragm, which forces steam with its entrained moisture out of the header into the separator body through the inlet port, the area of which is only slightly in excess of the pipe area, thus causing the steam and water to enter the receiver at a very high velocity.

In the vertical type, Fig. 11, the steam enters at the top and passes into the receiver chamber through the inlet port on the right. The inertia of the entrained moisture, due to its greater density, carries it to the bottom of the receiver out of the path of the steam, which circulates around the receiver and passes into the steam header again through the large outlet port shown on the left. Long baffle plates extend at an angle from each side of the continuous pipe, preventing any particles of moisture from being carried from inlet to outlet ports, or from creeping along the pipe.

In the horizontal type, Fig. 12, the steam enters at the left and passes down into the receiver through the inlet port, the entrainment being thereby carried to the bottom, while the steam, in order to pass into the header again, must circulate around in the receiver and rise to the outlet port in the top of the continuous pipe. Baffle plates similar to those in the vertical separator are provided along the sides of the header to prevent moisture from reaching the outlet port. The Elliott Co., Pittsburg, make a complete line of these separators, including angle types, etc., for pressures up to 250 lbs. per sq. in. They are made entirely of steel plates and piping with cast steel flanges screwed on and welded. The receiver chamber is made in either riveted pipe which forms an integral part of the steam header is in all cases welded to the receiver chamber.

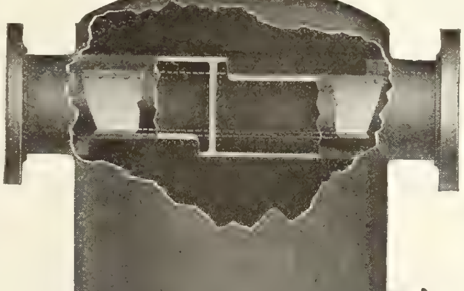


FIG. 12—HORIZONTAL "WELDERON" RECEIVER SEPARATOR WITH INTEGRAL PIPE AND DEFLECTING PLATES.

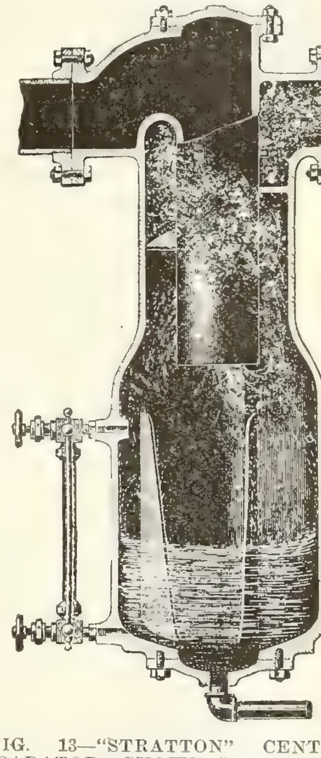


FIG. 13—"STRATTON" CENTRIFUGAL SEPARATOR SHOWING INTERCEPTING VANES IN RECEIVER AND CENTRAL OUTLET PIPE.

Stratton Steam Separator.

This device is illustrated in Fig. 13 and is designed and constructed to take advantage of the weight and velocity of the water in effecting separation. As shown in the sectional view, the water enters at the right hand side, traveling round behind the vertical outlet pipe, the helical passage causing it to strike the opposite wall at a slight angle, adhering to the wall and forming a thin sheet. This sheet of water flows forward and downward nearly to the bottom of the separator, where its circular motion is stopped by internal ribs, allowing it to collect in the bottom of the separator and flow into the drain pipe.

The current of steam, from which the

water first separates, continues its twisting motion downward to the lower end of the central vertical pipe which leads the steam to the outlet opening. This spinning action of the steam current

FIG. 14—VERTICAL "ELLIOTT" SEPARATOR WITH INVERTED VEE PLATE AND CONICAL FLANGES.

keeps the sheet of separated water out against the wall of the separator preventing it from returning inwards into the steam current after once leaving it.

The vanes in the receiver section of this separator are installed to arrest this rotation of the water so that proper drainage may take place. For convenience in connecting pipe lines, Stratton separators are made in both horizontal and vertical styles, with inlet and outlet openings arranged in any direction to suit conditions. For superheated steam and excessive pressures these separators are of cast steel construction throughout, three different classes being

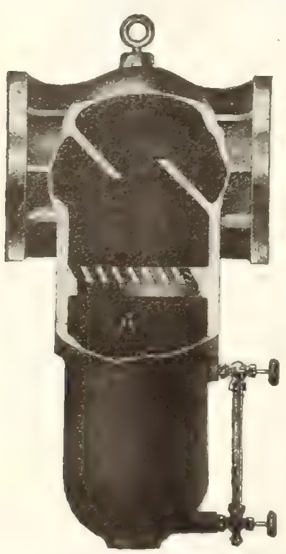


FIG. 15—HORIZONTAL "ELLIOTT" SEPARATOR SHOWING DEFLECTING PLATES AND ISOLATING GRID.

available with varying proportions of storage or receiver space to suit conditions. The Canadian Griscom-Russell Co., Montreal, are the builders of this separator.

Elliott Steam Separators

This device employs the angular baffle principle with suitable deflection of the steam current. Vertical and horizontal types are shown in section in Figs. 14 and 15. In the former, steam enters at the top and strikes the slanting surfaces of the inverted "V" cast over the central outlet pipe. The openings to the outlet pipe are located beneath the inverted "V" but above the line of its lower edges. To reach these openings, the steam must pass under the edges of the "V" so that the entrained moisture being of greater density, is thrown from the path of the steam to the waste chamber at the bottom and thence to drain. Situated below the "V" are conical flanges which prevent the separated water from creeping up to the steam outlets.

The horizontal Elliott Separator, Fig. 15, is similar to the vertical in that the steam strikes the baffle at an angle instead of in a straight line, resulting in a minimum pressure drop in the separator with more complete separation. On entering at the left, a slanting baffle deflects the steam downward, this change of direction, together with the action of gravity, throwing the entrainment down to the water chamber. A set of inclined bars forms a grating which separates

FIG. 16—SECTIONAL VIEW OF "COCHRANE" SEPARATOR SHOWING SIDE POSTS AROUND BAFFLE PLATE.

the water from the steam chamber, isolating it in a complete manner from the steam current.

Another slanting baffle is placed in front of the outlet passage in such a manner that its upper edge is higher than the lower edge of the left-hand baffle, preventing any escape of entrainment. The designs shown are suited for 250 lbs. pressure, being made of semi-steel and reinforced by webs on neck and body. The Elliott Co., Pittsburgh, make these separators in sizes up to 12 in.

Cochrane Steam Separators

The horizontal type of this separator is illustrated in Figs. 16 and 17, the separating element being a single baffle plate facing the inlet opening, which presents a suitably proportioned surface for the impingement of all the particles of liquid traveling in the current, vertical ribs being provided to prevent side travel of the separated liquid. The baffle plate extends across the diameter of the head, with the exception of two ports having an area exceeding that of the entering pipe. An opening exists between the baffle plate and the edge of the inlet, so that large quantities of free liquid pour directly into the well. This well is entirely below the course of the current, the underside of the baffle plate

FIG. 17 — HORIZONTAL "COCHRANE" SEPARATOR WITH SPECIAL RECEIVER CHAMBER.

being closed over to the outlet and provided with an internal drip pipe.

The ports are situated at the sides of the baffle plate and towards the top, which, however, is closed for a suitable amount to insure the steam passing round the sides. The vertical form, not illustrated is modified in design and construction to meet the different direction of the current while retaining the same principles of separation. The Cochrane separator is made by the Harrison Safety Boiler Works, Philadelphia, Pa., in a large variety of designs suited to all locations and duties.

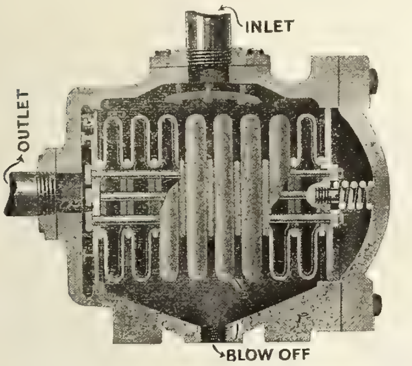
A GROWING practice is noted in foundries to paint the pattern so as to indicate the parts of a casting which are to be machined and the parts which are to be left rough. The point is that castings are sometimes spoiled because the moulder does not always know which part is to be finished in the machine shop. The parts of a pattern corresponding to parts requiring no machine work are painted grey, whilst the parts which are to be machined are painted yellow, with the parts of the pattern indicating the location of cores in red. Coloured cards are sometimes used for each pattern, for the use of the pattern-makes and sometimes for the moulder, with the result that fewer castings have been ruined on account of their being gated wrong than was formerly the case.

PROGRESS IN NEW EQUIPMENT

There is Here Provided in Compact Form a Monthly Compendium of Shipbuilding and Marine Engineering Auxiliary Product Achievement

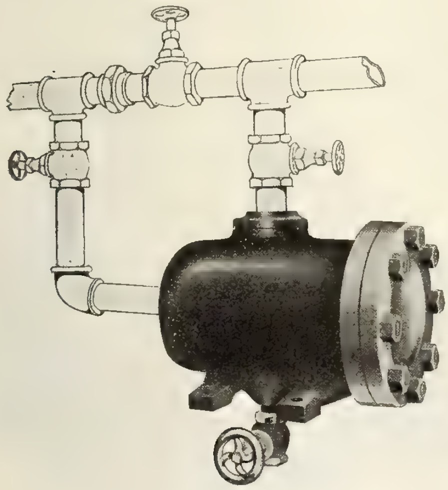
FEED WATER FILTER

THE accompanying illustrations show an interior and exterior view of the Reliance Feed Water Heater, designed, among other things, for the removal of oil from boiler feed water, specially adapted for marine purposes. As seen in the sectional view, the unfiltered water enters at the top and passes into the central portion of the chamber, being distributed in all directions by means of the



INTERIOR VIEW OF "RELIANCE" FEED WATER HEATER.

convex disc, which prevents the direct force of the influx from striking the fabric material on the outer portion of the cartridge. The cartridges are composed of thin copper perforated discs, covered with Turkish towelling, through which the water must be forced before it enters the discharge outlet; this causes the oil to be entirely separated and can be blown off at intervals. When installing this filter on the pipe line, it is necessary to provide

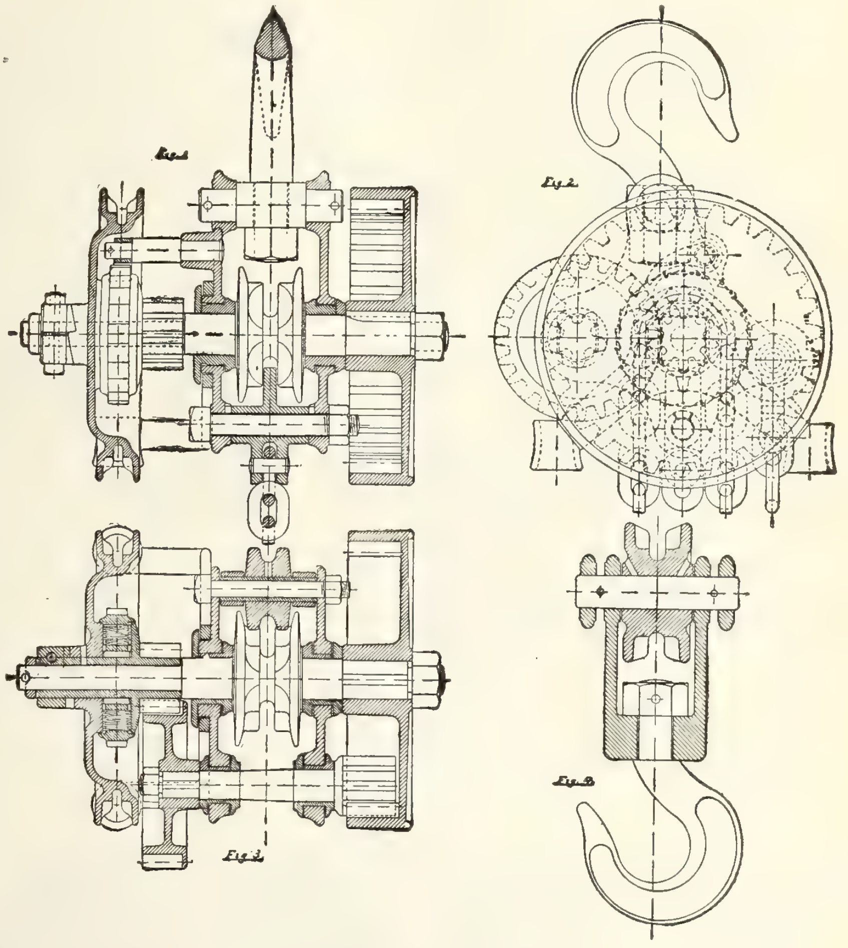


"RELIANCE" FEED WATER SHOWING PIPE CONNECTIONS.

a by-pass, so that the filter can be cleaned without shutting off the boiler supply. To reduce the "out-of-service" time to the minimum, an extra cartridge is supplied so that the lost time is only that required while the cartridges are being changed. Cleaning can take place while the other cartridge is in service. These filters are manufactured by Darling Bros., of Montreal.

TWO-SPEED CHAIN HOIST

THE accompanying illustrations show the mechanical construction of the Simplex chain hoist, one of a line of hoisting specialties manufactured by J. G. Speidel, Reading, Pa., a novel feature of the apparatus being the simple and ingenious method of securing two speeds.



TWO-SPEED CHAIN HOIST.

An endless hand chain is laid over the large chain wheel, which, in connection with a pinion and a brake wheel with ratchet teeth in the outer rim, form the automatic brake, which keeps the load from running down. These three parts, when put together, are handled like one piece, and turn loose on the reduced extension of the main shaft.

The pinion attached to the hand chain wheel drives a spur gear, which is keyed to a second shaft, at the end of which is another pinion, which engages with the teeth of an internal spur gear, which is keyed to the opposite end of the main shaft, to which is attached the lift chain wheel. Thus, by means of two pairs of spur gearing, motion is transmitted from the hand chain to the lift chain. By pulling on the hand chain, in one or the other direction, the load is either lifted or lowered.

In hoisting the load the brake wheel, with its ratchet teeth on the outer rim, revolves freely with the hand chain wheel and pinion, not causing any resistance, the ratchet pawl running freely over the teeth. As soon as the pull on the hand chain ceases, the pawl engages with the ratchet teeth on the brake wheel, keeping it from running backward, and so keeping the load suspended.

In lowering the load the hand chain is pulled in the opposite direction, and a slight pull is sufficient to overcome the friction of the automatic brake, thus allowing the load to descend and holding the same suspended again as soon as the operator stops pulling on the hand chain.

By a continuous pull on the hand chain the load can be lowered at a good speed.

Features of the design which make for positive action and flexibility of control are as follows: A pawl arrangement in the lower block, which locks the hoisting chain to the sheave, allowing light loads to be hoisted at double the speed used when working to capacity load; the guides through which the hand chain passes are closed rings attached to a swinging frame, which permits them to take up the position of least resistance when the chain is pulled at any angle, thus allowing the operator to stand well out from beneath the hoist without imposing undue wear on the chain and guides; the lift chain is prevented from jumping over the sprocket of the lift chain wheel by means of a guide roller, and a stripper, which runs up through the narrow groove of the lift chain wheel prevents the chain from sticking to the wheel.

This hoist is supplied in capacities ranging from 1,000 pounds up to 40,000 pounds, and it is claimed that one man can lift any load up to 16,000 pounds, above which two men are required.

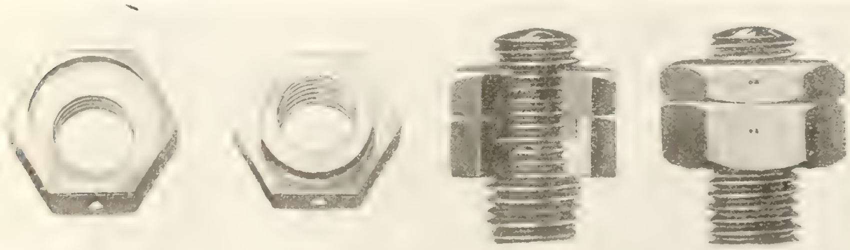
ECCENTRIC LOCKNUT

INHERENT defect in design, resulting in shortcoming or weakness sufficient to prevent its good points from being properly availed of has been the cause of failure in many types of locknuts which from time to time have been evolved with an aim to supplanting the ordinary slotted or castle nut with a spring washer or split pin. High cost, complicated construction, necessity for special tools to operate, damage to bolt threads and impossibility of re-use have variously operated against the complete success of any one locknut.

In an effort to overcome these objections, the Ross Locknut has been developed and is now being marketed by the Ross Locknut Co., 117 Leadenhall St., London, Eng., who have had it subjected to severe tests, including aeroplane service. This device derives its efficiency from the operation of a double eccentric the formation of which is shown in the accompanying illustration. The threaded holes are eccentric with the body of the nut, and the counterbore on one piece and the projecting portion of the other, while of the same diameter, are so disposed that when guide marks on two of the flats are brought together, the threaded holes are directly in line with each other and the nut turns freely.

The wrench embraces both parts while tightening up, after which the upper section is turned by itself so that its threaded bore tends to become eccentric with that of the lower section, due to the wedging action of the eccentric and the counterbore. The outer section may be turned in either direction to lock, and is unlocked by turning back again till the guide marks are in line.

This lock nut requires no tool other than the ordinary wrench; no drilling in the bolt; does not impair its own or the bolt threads; and can be re-used as often as required.

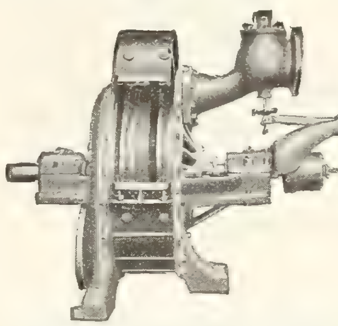


TWO-PART LOCKNUT UTILIZING ECCENTRIC PORTIONS TO OBTAIN LOCKING EFFECT.

STEAM TURBINE FOR FANS, BLOWERS AND PUMPS

THE Canadian General Electric Company is offering a Curtis Steam Turbine in a wide variety of capacities to drive fans, blowers and pumps for boiler feeding and circulating systems.

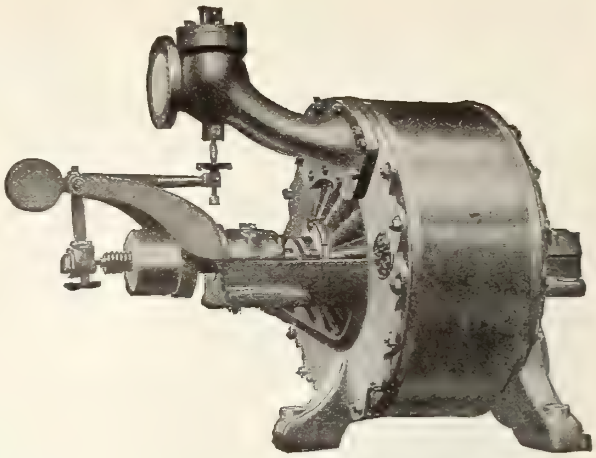
It is called the type L and is of the impulse type. The number of stages and rows of buckets vary with the capacity. The principles used and mechanical practice evident in the construction are the result of the vast experience of the manufacturers in producing turbines for practically every class of service.



SHOWING SPLIT WHEEL CASING OPENED FOR INSPECTION.

A split wheel casing is used to permit ready inspection of the buckets which are of bronze securely dovetailed into the rim of the wheel. The exhaust steam is free from oil and is well suited for heating feed water.

Speed regulation is close and reliable and the speed may be changed by hand wheel adjustment while the turbine is in operation. A constant running speed is maintained by a simple and powerful speed governor mounted directly on the shaft and controlling a double balanced piston valve type throttle.



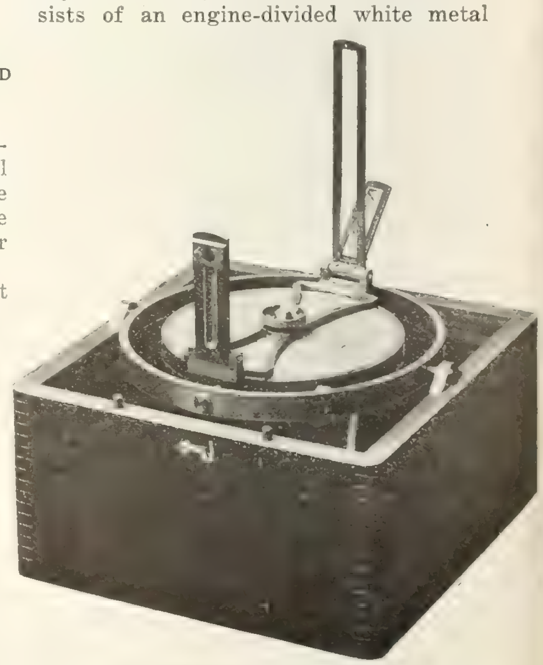
IMPULSE STEAM TURBINE FOR DRIVING FANS, BLOWERS AND PUMPS.

The main shaft carrying the turbine and governor runs on babbitted bearings with renewable linings, and is fitted with readily accessible packing glands.

Three feet support the rigid frame of the turbine to insure the bearings always being in line. The wheel casing is neatly lagged with planished iron.

IMPROVED PELORUS

THE accompanying engraving shows the latest design of pelorus, which is a recent addition to the line of compasses, sounding machines, and nautical instruments manufactured by Scythes & Co., Toronto, Ont. It consists of an engine-divided white metal compass dial, revolving in a flat disk suspended in gimbals, and a pair of sights with a revolving mirror over this dial.



IMPROVED PELORUS

The dial can be revolved in the dish

and clamped to any course; the sights also can be revolved freely over the dial and clamped to any azimuth or bearing. An improvement has been effected in the design of this instrument by making the hairline sight 3 in. longer than the peep sight, thereby making the instrument specially adaptable for star work.

There are also two sets of figures in the southern half of the dial, which enables the sight vanes to be clamped to the sun's true bearing as taken from the azimuth tables, without further calculation.

SIBERIAN TRADE REQUIREMENTS IN OIL ENGINES AND MARINE MOTORS

L. D. WILGRESS, Canadian Trade Commissioner for Siberia, sends the following particulars from Omsk regarding trade in Siberia in oil engines and marine motors. It is hoped that these particulars will assist Canadian manufacturers of the products in question to determine the prospects for developing business with this market.

Trade in Engines

A considerable demand was created in Western Siberia before the war for oil engines designed for various farm uses, such as the operation of flour mills, threshing, the pumping of water, etc. Previously the demand in this branch of trade was chiefly for portable steam engines with colonial fireboxes, enlarged especially for burning wood. With the amount of wood available for fuel purposes, this was considered the engine most suitable for use in Siberia. The rise in the price of wood, the prevalence of alkaline water in certain districts and particularly the campaign conducted by Swedish and other manufacturers, gradually created a demand for oil engines, with the result that the number of portable steam engines sold each year remained stationary, while the trade in the former greatly increased. Lately the business in steam engines has been largely confined to dealers in power-threshing outfits. These have been chiefly of British and German manufacture, the largest sale being in sets with a nominal 10 horse-power, but an actual 36 horse-power.

Types of Oil Engine in Demand

The oil engines sold in Western Siberia previous to the war were chiefly of Swedish and Russian manufacture, supplemented b ya limited import from Germany and Great Britain. These engines were either sold to co-operative societies for the operation of flour mills, creameries, etc., or to individual peasants for general farm purposes. For the operation of flour mills and similar heavy purposes the most usual size required is from 32 to 40 horse-power. The largest demand, however, is for one-cylinder vertical motors of from 10 to 16 horse-power size, suitable for operating threshers, small flour mills and for other farm uses. During the summer the farmers use their engines for threshing grain and other purposes, while during the winter they grind the grain by operating small unit flour mills, using their oil engines for power. There is also a considerable sale of the smaller sizes of engines of from 4 to 8 horse-power, which are used for pumping water, operating threshers, etc. The tendency has been, however, for a greater number of the larger sizes of engines to be sold each year, since the economy of purchasing a somewhat larger engine is becoming recognized.

The fuel used for oil engines in Western Siberia is either kerosene or what is locally known as "naphtha." This latter is similar to what is sometimes referred to in America as crude oil and is practically kerosene before the benzine is extracted from it. Gasoline is too dear to permit of its use for fuel purposes in Siberia. Since the outbreak of the war the high cost of kerosene and naphtha has placed the owners of oil engines at a disadvantage.

The requirements of the market call for an engine which is above all things simple to operate. This is one of the objections held against certain engines of the North American type as compared with those manufactured in Sweden and Germany. There is also a prejudice among the Siberian peasants against the horizontal motor, it being held that the friction is greater than in engines of the vertical type. The accompanying illustration shows a 10 horse-power engine manufactured by a well-known German firm. This oil engine is of the type which has enjoyed the largest sale in this market. The retail price of this particular motor before the war was 1,800 roubles. A 5 horse-power engine manufactured by the same firm sold for 750 roubles. These prices may be taken as representative of the prices paid for oil engines in Western Siberia previous to the outbreak of the war.

Marine Motors

There should be an opening for the sale of Canadian marine motors in the Russian Far East. The development of the fishing industry of Eastern Siberia has led to an increased use of motor-propelled boats, while sailing vessels with auxiliary motor-power have proved to be the best suited for the trade along the coast where the population is very scattered. Motor-boats are also beginning to be used to a greater extent on the principal rivers of Siberia for purposes of communication and in connection with the fisheries. Motor-boating for pleasure is still in its infancy, although the sport appears to have gained a foothold in the principal towns. Motors of Swedish manufacture are chiefly to be seen, but it is reported that the sales of American motors are increasing in Eastern Siberia, where the conditions of competition are more favorable to Canadian and United States manufacturers. Kerosene is the principal fuel used, gasolene being too dear for general use. The type of marine motor required in Siberia is one of strong construction and simple design. All sizes are in demand varying according to the purposes for which the motors are to be used. The names of some of the principal dealers in Vladivostok may be obtained on application to the Department of Trade and Commerce, Ottawa.

"VATERLAND" READY FOR SEA

BEFORE the interned German liner Vaterland was taken over by the United States Government her German crew made strenuous efforts to so damage the huge vessel that it would never be seaworthy again. Despite their malicious if inglorious efforts the Vaterland is now nearly ready to be put into commission, great credit being due to the American repairers who have now placed the vessel at the service of the Allied cause. It is, of course, generally known (says *The Shipbuilder*) that the officers of the larger liners saw to it that the most vital parts of the machinery were damaged, but the amount of ingenuity applied to this end has been but dimly realized.

On some vessels every bolt and nut had to be carefully examined, for it was found that many of the more vital ones had been sawn half through and replaced, and had steam chests been put under pressure a violent explosion would have taken place.

Quite a common practice seems to have been to place a steel wedge in the cylinder heads so as to break the piston rod, while a ring of holes was often drilled in the cylinder walls.

Great care had to be exercised by the surveyors who examined the vessels, for death-traps lurked at every turn. The turning of a door handle might have set an infernal machine working that would have wrecked the ship. On the other hand, many dummy bombs were laid about, apparently to add zest to the search. The most common place for live bombs to be hidden was among the coal bunkers, many of them having been cleverly disguised as lumps of coal.

A frequent occurrence was to find valves removed from valve boxes, and in some cases the watertight floors of the double bottom had been riddled with holes.

Sea valves, shell riveting, steering gear, compasses, watertight doors and manholes—all gave evidence of diabolical cleverness.

RECENT experiments have shown that one coat of paint, properly applied, is a better preventative of rust on metal than are several coats. The "Bulletin de la Societe des Ingenieurs Civils de France" states that iron plates well cleaned and polished were coated, some with one coat and some with two, three or more coats of paint, and then exposed to the action of steam for a whole day, after which the paint was removed and the plates were examined. The first was as bright as it was before exposure to steam, the second showed a few rust spots, the third was still more attacked, and the fourth entirely so. This result is due to the fact that the deeper layers dry badly and tend to dissolve the uppermost coating, increasing its porosity to air and moisture.

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Vol. VII — NOVEMBER, 1917 — No. 11

PRINCIPAL CONTENTS

INDUSTRIAL ACTIVITY ANTICIPATES "VICTORY LOAN" SUCCESS

On every hand, the duty of investing their savings in Victory Bonds is being so strongly impressed on our people that it is almost superfluous for us to add a further word of exhortation. A selling organization unparalleled in the history of the Dominion, supported by the leading business and financial personalities of the latter and backed by the most effective publicity methods—direct and indirect—is carrying the crusade to the most remote corners of the land with conviction to each citizen individually of the necessity of raising the millions aimed at to bring to a successful and speedy termination the world war in which we with our Allies are so deeply involved.

We would like to impress upon our readers, however, apart altogether from motives of duty, the pecuniary advantages to be derived from participation in the loan. As a cold business proposition, investment in Victory Bonds is a most desirable venture, furnishing an opportunity of rarest occurrence and of extraordinary possibilities. The yield, indeed, on these Victory Bonds is so high that some patriots will be inclined to question its necessity.

There is another side to the Victory Loan. It has been brought home to us in recent months that for the duration of the war at least the wheels of industry in Canada must needs revolve through the power medium of money supplied by her own people. In a word, much business is available for our manufacturing plants—metal-working and otherwise; same is procurable, however, for the most part, only if we bear its financing on our own shoulders in the shape of credit to the Imperial Government.

Munitions making in Canada has for several months been ebbing, and until quite recently had every appearance of becoming a more or less negligible quantity. Realization of the imminence of such a possibility was, needless to say, little relished by our business interests. Investigation of the situation disclosed the fact that financing of munitions orders was the chief obstacle in the way, as a result effort was at once directed to satisfactorily overcome the trouble. Flotation of a Victory Loan of some $300,000,000 was planned, and while the amount secured to date, with the subscription campaign more than half way through, is nearly $100,000,000 short of the above total, ultimate success is well assured, and what is perhaps of greatest importance, the flow of shell contracts on behalf of the Imperial Government has been resumed, and our metal-working plants are again beginning to hum with activity.

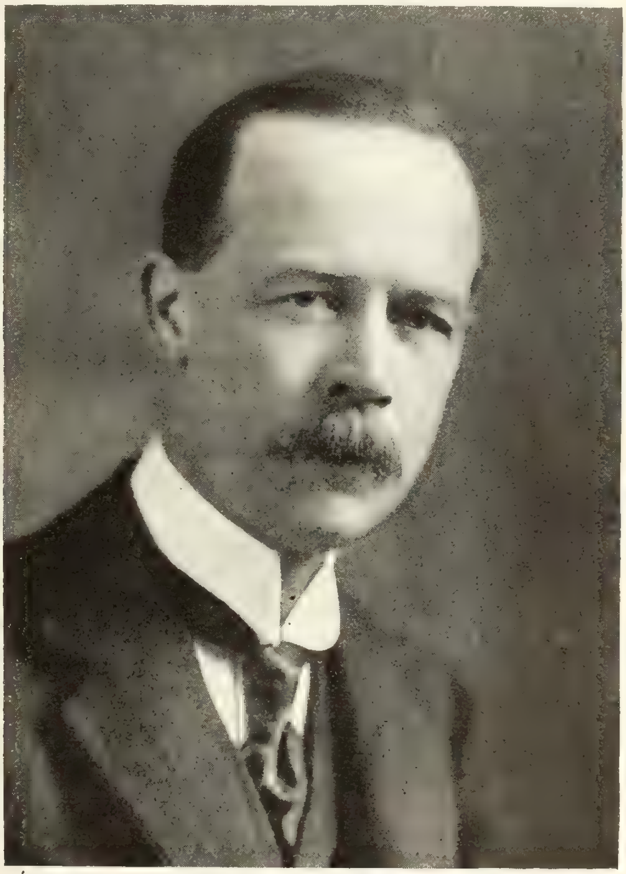
Not only has shell-making been resumed on behalf of the Imperial Government, but contracts of considerable value covering 75 and 155 millimetre shells have been placed in Canada by the U.S. Government. Airplane engine manufacture is a further development of the industrial situation in Canada.

Needless to say, not a little of the cash to be made available to our Finance Minister will find its way into Canada's shipbuilding and marine engineering industries, and in view of their greater degree of permanence, compared with munitions making, and the fact that much of our opportunity for export trade overseas will be dependent on our both building and owning a fleet, substantial in number, capacity, and equipment, of freight carriers, it seems reasonable to expect that our Government will see to it that financial aid is readily forthcoming for the stabilizing and propagation of these important lines.

Not only are our established shipyards beginning to find their stride in the matter of output, but a more widespread confidence is being displayed by our financial and business interests in the future prospects of these twin crafts. As a result, greater activity is becoming manifest in the creation of new plants.

CANADIAN MARINE "HEADLIGHTS"

LAWRENCE LEOPOLD HENDERSON, vice-president and managing director, Montreal Transportation Co., grain and general forwarders through the Great Lakes, St. Lawrence River and Gulf of St. Lawrence, 14 Place Royale, Montreal; director, National Real Estate and Investment Co.; director, Montreal Dry Dock & Ship Repairing Co.; director, Rothesay Realty Co., was born in Kingston, Ont., March 5, 1866, son of Peter Robertson and Henrietta Jane (Sweetland) Henderson. He was



LAWRENCE LEOPOLD HENDERSON.

educated at Kingston Private Schools, and at the Collegiate Institute, and began his business career with the Montreal Transportation Co., 1884; passing through various departments; becoming agent at Kingston in 1896, and general manager, 1909. He was a member, City Council, Kingston, 1907-1908; member, School Board, Kingston, 1904-1906, and is at present, member, Montreal Board of Trade, and member, Executive Committee, Dominion Marine Association.

On leaving Kingston for Montreal, Mr. Henderson was presented by the Board of Trade there with a silver salver, and by the employees of the Montreal Transportation Co. with a silver loving cup. He was elected president, Dominion Marine Association for the years 1913-1914.

Mr. Henderson married Jennie Lena Spencer, daughter of Levi Bradley Spencer, Kingston, April, 1890; there being two sons and four daughters of the union.

His Clubs are Canada, Engineers', St. George's Snowshoe, Heather Curling, Frontenac (Kingston), Kingston Curling (Honorary Member), Country (Montreal), and American Universities (London, Eng.). In politics he is Conservative, and in religious creed, Presbyterian. The family residence is 581 Lansdowne Ave., Westmount, Que.

—Photo, courtesy British and Colonial Press.

Standardization of Marine Engines for Cargo Steamers*

By W. V. Lang

Standardization of propelling and auxiliary machinery aboard ship will contribute materially to greater service efficiency, and therefore to reduced operating expense. Equally with the shipowner, however, its benefits will be felt and appreciated by operators from the superintendent engineer downwards, and if in the development of designs and the working out of details, consideration is given the views and ideas of men experienced in the service, there is little doubt but that a new era in ocean transportation is on the eve of being ushered in.

IT is inconceivable that any standardized marine engine should be designed and built for merchant commerce by the shore staffs of engine builders—however expert and technical—without that large body of men represented in and by the title of an Institute such as this having some say and criticism in any such projected design; i.e., marine and classification surveyors, consulting engineers and superintendents, who have the drawing up of specifications on behalf of the ship owner, and the inspection, maintenance and repair of such machinery during its life; those directly in charge of such engines at sea and in port, who, from their intimate and personal knowledge of result in action under actual conditions at sea, can best inform and advise of much that can only be learned by hard experience—such experience as is represented by the official Board of Trade certificate of competency—and to whom I especially address these notes, to invite and open a discussion which, I trust, may not be without profit to us all.

The transactions of the N.E. Coast Institute of Shipbuilders and Engineers at the meeting held in Newcastle in January marks a great event in marine-engine construction, in that the dogmas and old-fashioned ideas of numerous designers and builders are sought to be skilfully focussed upon one type and approved pattern. At the meeting, men at the head of world-renowned firms, whose machinery propels a large proportion of our mercantile tonnage in all waters of the globe, sat together and discussed economies, ratios, diameters, and standardization. A hopeful sign indeed, when managers meet with a view to scrap all differences in minor things and aim to unite on main principles. It was a kindly and proper reference, too, that was made to the presence of that large body of men who superintend such machinery from the inception of its need by the owner until it disappears in sale or storm or wreck.

No machinery for marine purposes can be successful in wear and tear were it designed and built by calculation alone. Motive power owes much to the technical man and the designer, but it is the practical man who, in the past, the present, and the future, tests the results, and by attention to details brings the design to success in operation.

Interests Involved

In relation to marine engineering, we have, broadly, two interests—the seller and the buyer. The former represents works, management, and design; the latter, commerce, maintenance, and result. As a constructive asset, "Goodwill" only goes with the former; i.e., "works" stands or falls by the result of the product, and "result" runs into years of experience, and may be summed up tersely as wear and tear.

Those of us who have had long association with wear and tear can best appreciate the differences between the respective "jobs" we have had to deal with, and where, in a specification, it is necessary to add, here and there as experience dictates, to the parts requiring special attention. I cannot, perhaps, make my point clearer than by quoting the remark made to me years ago by a brother superintendent when comparing notes upon a firm's product. His verdict was: "Too much of the Czar of Russia, and too little white metal."

It would be a misfortune for a standard marine engine to be put upon the market without due consideration being given to the after years of its life; and as to that consideration, as a member of the army of maintenance, I would like to make some remarks. It will be easier to classify them under heads, for engines of (say) 1000 to 2500 i.h.p. of typical East Coast pattern, as follows:—

Design

A composite design, embracing the best and eliminating the faults in individual engines, should be the object and the outcome of all deliberations. It is to be hoped, and fully expected, that simplicity with ample strength and rigidity will characterize an adopted design; and from the data available in the various existing designs there should be no lack—or need of revision—in thickness of cast-iron sections or flanges, or of bearing and wearing surfaces, nor of efficient guides; the minimum of vibration to working parts; or of accessibility to all and every part, and ease in overhauling and adjustment.

Bedplates are usually found in two designs—box section bolted direct on tank top, guide section bolted on a built seating. The former necessitates the holding-down bolts going through the watertight plating, the latter allows of independent bolting and re-bolting. It is important in any design that the holding-down bolts be easily accessible; also that pump facing and jointing bolts are easily get-at-able. Where an unnecessary depth exists between the tank top and the level of the engine platforms it is a pity that such lost space is not better utilized by making the engine-room tank deeper, thereby increasing water ballast or boiler-feed capacity.

Life of a Marine Engine

For the purpose of allowances for wear and tear, I have assumed a period of (say) 30 years. We all know "jobs" of near that age which are, broadly speaking, as good as ever, and I personally lost from my superintendence in 1915 (by that cowardly and insane torpedo attack on commerce), a Palmer job of 30 years of age, still good for years of sea going, and the double-ended boilers of which had the original furnaces, without patches.

Sizes of engines might be arranged for by leading engine builders on the basis of i.h.p., rising by increases of (say) 500 h.p. per size, from 1000 to 2500 i.h.p., to suit the standard hulls that may be evolved (from the prevailing idea on this subject), and which might give (say vaguely for the purpose of the argument) vessels of 3500, 5000, 7500, and 10,000 tons deadweight. Such standardized engines might, would, or could have cylinders of equal diameter and centres, similar stroke rising (say by 3 in. per size) and similar disposal of valve chests, etc.

It would then become possible—making due allowance for individualism in the respective builders' design and finish, and attention to details, etc.—to have the component parts of such standardized engine sets absolutely identical in length, diameter, and gauge. So much so that manufacturing firms could specialize in piston rods, valve spindles, connecting rods, crank shaft pieces, thrust propeller, and tunnel shafts (except the make-up length to finish to a size), air and circulating pump, buckets and rods, feed and bilge rams, eccentric and drag rods, etc.; and one builder could even take the surplus or spare parts from another to help forward his own erections; whilst a standardization of prices for spares and renewals would keep down un-remunerative production and competition. I suggest there is nothing new in this hypothesis; it is merely carrying into mercantile design on a grand scale what the Navy does in types of war ships; and that without materially altering general practice but only consolidating upon output and reducing cost and maintenance.

Metric System

By all means let the decimal system be introduced into modern dimension

*Institute of Marine Engineers' paper.

and money; but, as it is bound to have a transition period, the standard sizes should be in the system that we are all familiar with. The equivalent metric unit should be shown in parallel column, that it may become known by easy comparisons. Those of us of mature age will never— in our time—learn to think in other than the 12-in. rule and its fractional sub-divisions. All modern rules, straight-edges, and tapes should be marked in both systems.

Scantlings

These remarks are not intended to touch upon the ground of expert calculations of ratios, diameters, or surfaces. There must be too much modern practice, data, and experimental results at hand to leave much error permissible in any standardized type of marine engine that a committee of professors, designers, and builders could produce; therefore, only the wear-and-tear problem is before us in this paper. The marine engineer, as such, is only concerned with doing the best possible with the job put into his charge, and the superintendent over all. It must not be overlooked that the cargo vessel of the type herein considered is a product for sale and purchase; and, in nine cases out of ten, a superintendent engineer has nothing whatever to say as to the builder or size of engine.

Reliability is everything in a cargo-boat engine. Such steamers trade the world over; to such out-of-the-way places as Mauritius, Ocean Island, and Iquique, and places where practically no facilities exist for repair or removal. A run of a month or two months is nothing nowadays to a tramp steamer, and a run of nearly 80 days, without an easement or alteration of the stop valve, can be vouched for by the writer, for a typical East Coast job of 2000 i.h.p. Neither the Navy nor the passenger services can beat the work of the ocean tramp steamer where reliability comes in. It is important that this feature should not be weakened in any new design. Equally should a steamer's time between ports bear a close approximation to calculation, but it is the shipbuilder and his designer who are chiefly responsible in this matter, and unless the engine builder is a partner in the modelling, the "best all-round ship" will never be produced.

Speed and fuel consumption are the twin factors that the shipowner is most interested in, next to deadweight. If a ship can transport 8000 tons deadweight a distance of 240 nautical miles (equal to 276 land miles) in 24 hours at an expenditure of 33 tons of coal, he will not complain. I have such a vessel in mind. She is 400 ft. x 52 ft. x 26 ft., loaded draught with a co-efficient of 78. It may be taken as good practice that the beam of a cargo steamer should not exceed 7½ beams to length, and at such a proportion of hull good ends are obtainable. The vessel that cannot average 240 miles per day to the River Plate and back is too slow for modern needs and the bustling times ahead.

As an owner's man, I cannot too strenuously urge that this important factor should be kept in view. A cheap first cost will be a dear investment if its maintenance is costly. There are no rest houses on the long sea routes, and stoppage for adjustment is "bad form" at sea. An American once remarked "You Britishers make a thing to last for ever, but we Americans make a thing to give a man another job." We don't want the repairer oftener than possible on the marine engine, and provision is required for the contingencies of wear and tear.

Power vs. Weight

It seems to me that in the majority of cases there is too little power and too much weight. No cargo-boat engines are run at sea full opened out. If they were the boilers are not capable of maintaining steam. The average tramp steamer lumbers along at a 54-revolution gait with the wheel 2¼ turns back and the "links" well in. Why not a size smaller engine in the same vessel running at 60 revolutions, with the leads and cut offs at a calculated maximum of efficiency and a full head of steam in the h.p. chest? The present useless reserve of engine power is only exerted once, and that is at the trial trip, with a good fireman on each boiler, good steaming coal on the plates, clean tubes and fires, and—plenty of refreshments. We want boilers that will steam easily through the Tropics with the wind aft, bunkers of the usual "through-and-through" quality, and the very ordinary firemen based on a calculation of 3 tons per man on the consumption. This, with tubes unswept for a week, is the proper test for size of boilers in relation to speed.

Cylinders

It is for the expert to decide the ratios and clearances, but the calculations should be for sea conditions and not for indicator card marking on trial trips. The least that should be calculated on in deciding the thickness of cylinder walls and liner, is for possibly reboring the h.p. thrice, and the m.p. twice, and the l.p. once, in a profitable life of thirty years. It might reasonably be considered that the minimum allowance for reboring a cylinder once would be (say) 3-16 in. for a 24-in. h.p. cylinder, ¼ in. for a 40-in. m.p. cylinder, and 7-16 in. for a 68-in. l.p. cylinder.

Pistons

Doubtless these always will be best of cast iron. The all-important thing is that the core plugs should be in the side, and not on the top or bottom. I have to record a smash-up at sea through a core plug—in the latter arrangement—falling out.

Undoubtedly, the simplest and cheapest rings are those of the Ramsbottom type, and they are hard to beat when in good order; but most engineers prefer a more durable ring, and one possessing greater efficiency. All I propose to remark on this head is that depth between flange and space between cylinder wall and piston body should be designed to suit the leading makes of rings.

Piston Rods

Whilst leaving the minimum of scantling to experts, the owner's superintendent is entitled to claim allowance for wear and tear. There is no "expectation of life" for such parts subject to friction. A rod may be in good order after twelve years; it may require turning up in twelve months. I consider a reasonable allowance for turning down (or "truing up") in lathe would be 1-16 per inch of minimum diameter. That is to say, for a 6-inch. estimated diameter, ⅜ in. of excess should be allowed for (say) twice truing up the rod. It would then become condemnable when badly worn for the third time. Such extra diameter should be over and above the size at top of cone, and it would tend to a better running rod if the lower portion of the rod—below the gland—was turned down to the rule size. This would permit of ridging (or "swell" due to wear), being easily filed away, and the rod kept true on its working part.

Valve Spindles

These are even more subject to turning up in the lathe than piston rods, and not less, but rather the more, allowance should be made for wear and tear. Such rods, too, frequently come for renewal, owing to lack of allowance for turning down, original sizes quite frequently only permitting of one such treatment. H.p. spindles often require truing up in 2 to 3 years regularly! This is due to several reasons—principally (1) soft material; (2) hard or faulty packing; (3) careless gland adjustment; (4) wet steam. It is not usually desirable to weld a new end on a main valve spindle. The part working in the guide bush or brasses should be "sewelled" and reduced to the rule diameter at each side of the travel to prevent ridging. As regards the method of securing the valve, the clamped (lugged) nut is a very satisfactory arrangement, adjustable to a nicety and safely secured by the screw bolts. Ordinary double nuts are unreliable, and difficult to accurately adjust. Some makers fit a similar clamp over collars, but adjustment has then to be made by washers to take up the slack.

Shafting

The present revised rules of Lloyds (as the premier classification society), appear ample for all shaft diameters, and, presumably, cover for a reasonable wear in the journal, but it is in every way desirable to allow a little over the rule for a possible accident, necessitating a resetting and truing up in the lathe; or a new journal end or crank pin, necessitating truing up the entire crank piece. An extra ⅛ in. on the crank pin and journals would cover this. The thrust is not liable to above; it is the surfaces of the collars that may require refacing up at some time or other. The shaft should be reversible. Tunnel shafting should be swelled (say a ¼ in.) in way of bearings. Propeller (or tail) shaft

should be as stout as possible. It is perfectly easy to effect this by carrying the peak bulkhead well back in the way of the after recess.

The Propeller

This is the least considered feature of a marine engine. A steamer is contracted for; machinery to the value of $50,000 is installed; the best of the midship section is appropriated to machinery and bunker space; thousands of tons of bunkers are consumed annually, and hundreds of dollars paid in crew wages—to turn a chunk of cast iron costing $500. If $100 extra was asked for grinding up and facing smooth the surface of the blades, nine out of ten owners would refuse to pay it. Assuming diameter, pitch, and surface to be identical, it does not require much imagination to assume that a bronze propeller, being lighter and thinner, must show better results, and without the assistance of any expert evidence we might reasonably assume an increase of (say) 2 revolutions per minute, and anything up to ½ knot increase on a 10-knot basis. Yet the first cost of $2,500 to $3,000 stands in the way of the maximum of efficiency. In a standardized type of ship it will be possible to experiment, and really ascertain the best form, diameter, pitch, and surface of a suitable propeller.

Eccentrics

I see by the N.E. discussion that sheaves and straps of same width be standardized: all fitted on the shaft journals and none on the couplings! I only know that you cannot have the go-ahead sheaves too wide, but to get go-ahead surface you must reduce go-astern, as the fore and aft space is limited. Provided the go-ahead is of ample width, it is preferable if the go-astern is interchangeable. That top and bottom halves are "interchangeable and reversible" is important, and what I have specified for some years past. Eccentric troughs should never be omitted; they save wear and tear enormously.

Condensers

In a new design for main engines these could be of the round-bodied separate type, either placed on brackets at the back of engine or entirely apart. The body could be of cast iron, or w.i., or steel plate. Such detail of design or position would not matter; the chief point for standardization is that the brass tubes should be all the same diameter, length, and gauge for one or more sizes of engines. The difference in surface would be merely a matter of number of tubes, viz., larger diameter of condenser body. The great advantage would be the ease of obtaining condenser tubes, as obviously a standard size would permit of stocking by either the engine builder or the manufacturer, or both, to their mutual advantage in cost and time and to the owner in renewal.

Air Pump

It is not our province here to compare the ordinary type of bucket—having head and foot valves—with the valveless type having head valves only. The discussion at the Newcastle Institute suggested a ratio of diameter, and it is for experts—together with the results of practice—to make due allowances for wear and tear and consequent loss of efficiency. Such mean loss of efficiency in any pump should be the calculation of its power, and not that of a new pump with everything working to technical calculation. The valves should be the same size throughout, but the lifts would naturally vary a little. To prevent the fouling of the engine-room atmosphere, the air pump overflow pipe should have an atmospheric air exhaust. Air and circulating rods should be interchangeable. They are so in some jobs.

Circulating Pump

This calls for no special remark, but the valves should be arranged horizontally, and can then be of the metallic type and interchangeable with the air pump. The rod should also be interchangeable with the air pump rod. A circulating pump would be more efficient if the bucket were fitted with brass rings of the Ramsbottom type, but it is a question if worth the extra expense.

Auxiliary Pumps, etc.

There could be no conceivable sense in specifying any one or particular make of pump or auxiliary for a standard engine specification; that would merely bestow a monopoly and congest one firm's workshops, and ruin or be greatly detrimental to the many other manufacturers of similar and quite possibly equal (or even better) productions. The all-important point to maintenance is that spare parts, or renewal (in the event of an accident), should be reasonably prompt, and to that end (especially in view of the things we have learnt since 1914), no foreign-made fitting should be found in a steamer built in this country for a British firm. For convenience of maintenance, ordering of spares, etc., it is much to the owner's interests that the various auxiliaries and the deck machinery should be from as few sub-contracting firms as possible, and the interchangeability of component parts—especially piston rings, suction and delivery valves and seatings, etc.—as practicable as possible.

Main Injection

The usual position, i.e., just above the turn of bilge, is necessitated by submergence when light ship, but a most desirable fitting is a second, or duplicate injection valve (say) 10-12 ft. higher up the side. When crossing bars and steaming up rivers or manoeuvring into or out of river berths, the lower injection valve would be shut off, and liability to choking of the circulating pump—and scoring by same—entirely removed. I have known several cases where such an arrangement would have prevented stoppage of the main engines at a time when the steamer was aground on a sandbank, and saving of tugs and salvage claims that ensued as a natural consequence. I consider marine insurance should encourage such items in a vessel—together with large ballast pumps and large suction pipes—as tending to reduce risks and the high costs of salvage claims.

Main Stop Valves

A standard valve by valve specialists would be a great improvement on present diverse designs, all more or less steam tight, and more often leaky than tight. Some are laborious arrangements with V threads, requiring a number of revolutions from full open to shut; others require a lever on the wheel to close them tightly. A proper main stop valve is an important fitting, and represents both safety and speed in handling high-pressure engines. The valve should be more or less an equilibrium valve, and preferably with a pilot valve. This is not a fitment for amateur design nor for the experimental draughtsman.

Valves.

In air, circulating, feed, bilge, and ballast pumps, it is quite a question of arrangement as to whether valves for the above, if of the metallic or disc type, should not be the same size for all. At the outside, two sizes might be arranged for so as to reduce the present large number of sizes required when renewing. Flat disc valves in the boiler-feed checks could at any rate be interchangeable with the main feed and bilge pump valves, and the air, circulating and ballast pump valves be alike and interchangeable.

Standardized Fittings

It is equally important in standardizing main engine parts that the valves, cocks, mountings, pipe flanges, and scantlings should be equally considered and standardized for copper, wrought iron, steel, cast iron, or lead pipes and connections. There is, or was, a Standards Committee on such matters, including threads, etc., but I am certain their deliberations have never penetrated into marine-engine practice, for the variety of fittings and diversity of flange diameters in the engine-room is truly bewildering.

In this respect there would be a great gain in standardizing on proportions of flange diameter to bore, pitch, number of bolts, etc. Let us, as an awakened people, discard the foreign-made "patent" or component part, not only for our marine engines, but, let us hope, for all our needs where our own brawn and brains and our well-equipped works are capable of producing them. When on this head may we briefly refer to the splendid national service of our women-folk, who have so ably filled the need of standardized fittings for the army and navy munitionment, and suggest that there is ample future employment for all these trained women and the new factories to produce in this country for the future that late enormous importation of German electrical fittings, hardware, motor accessories, clocks, and instruments that have taken millions to pay for annually, and which production in this country—chiefly by our women—would not affect or compete in the slightest degree with the recognized trades unionist employ-

ments of the country. All this talk and jealousy regarding women competing with home workers wants scrapping. It is the British women who have stepped into the breach to assist our arms to victory, and may they remain, and be honorably allowed to remain, to assist in keeping the Hun and all his works out of our Motherland and Empire.

Non-Standardization

I want to be quite clear on the point, viz., I do not advocate standardization of makes of non-essential parts. You do not expect to ever renew main engine cylinders or bedplates, or the boiler shells, nor would there be any object gained in one particular make of auxiliary. On the contrary, standardization should aim at a specification for sizes of the essential parts, mainly the component parts subject to assemblage and renewal—whether to replace wear and tear or as spare gear. Anything tending to "corner" requirements by the nomination of any one firm or firms will defeat the object of standardization, which should be to produce in plenty and economically—consistent with reasonable and fair profit—this mighty factor of international commerce.

Lubrication

With a new standardized type of marine engine, it seems to me that economy in this particular is deserving of attention. At present the sizes of engines we are commenting upon consume an average of 2½ to 3½ gallons of engine oil per day, which, at 60 cents per gallon, is a large expense per annum. If solid lubricant, in screw-down spring cups, could be fitted to main shafting, rocking, and weigh shafts, eccentric rod and drag link ends and pump links, eccentric straps, etc., it would greatly reduce oil used and wasted, and solve the greasing question.

Piping Arrangements

There seems to be no symmetry or design in the average piping arrangement, nor any provision for an additional supply, or indeed for the required capacity of steam and exhaust areas of auxiliaries if all are working together. A simpler arrangement can be made when junction pieces are introduced for the distribution of the steam services and connections from exhausts brought to a c.i. junction box, thereby simplifying the control to atmosphere, condenser, or to the l.p. chest. It also permits of suitable drainage. A prize of $250 for the best piping arrangement in a typical cargo boat would, I doubt not, set some brains busy with the lighter tools of our profession.

Nothing is more wasteful and uneconomical than the practice with some engine builders of running a single steam pipe fore and aft the machinery space, with branch pipes to the winches, steering gear, and all auxiliary pumps, etc. This occasions steam being on everything all the time, with the consequent leakages and loss by radiation of heat. Surely in a standardized design something better can be devised and better proportions of pipe areas arranged.

Exhausts at sea, from the steam-steering gear and dynamo engine, is well worth carrying into the l.p. steam chest. There is an appreciable increased i.h.p. shown on the l.p. indicator card.

Injector

This is an auxiliary I have fitted during the past twelve years. It is a valuable duplication to boiler feed in port, and puts the water in at a high temperature. By specifying "with salt water cones" a suitable marine injector is procurable. By standardizing the pattern a spare injector can be kept at the makers, always ready to exchange for one that requires renewal of the cones.

Gratings

In way of the ordinary top gratings there should be arranged—at back and front—a loose section, easily lifted out and in the proper position and of sufficient size, to lift out or put down any auxiliary pump, evaporator, or the pump levers at the back, and a crank shaft piece at the front. At present—in most jobs—there is no such provision, such requirements usually entailing unbolting the whole structure on one or the other side.

Skylights should, without exception, be provided with bolted sections of sufficient size to enable any engine part to be lifted out without recourse to unriveting. Skylight design might be much improved to give a maximum of light and air service.

Main Boilers

It seems a pity that there are not similar ideas as to the strength of boiler scantlings between the Classification Societies and the Board of Trade. One wonders why, at this stage of marine engine and boiler practice, the Board of Trade should consider that some parts—particularly boiler shells—require, under the rules, such additional thicknesses. The only explanation to the ordinary mind is that their rules require revision in the light of modern improvement of material and workmanship, for if 1 3/16 in. is good enough for a given w.p. for a first-class cargo steamer carrying, say, 75 of a crew, why should a small passenger ship, carrying, say, a total on her certificate of 50 persons, and having a similar size boiler and w.p. require, say, a 1⅜ in. steel plate? I am not giving exact figures, but the difference is something about that named.

Where this anomaly comes in to the detriment of the cargo steamer—particularly of the shelter-decker or 'tween-deck steamer—is when a temporary certificate is required for the carrying of labor emigrants, coolies, troops, or similar human freight. For such conditions the w.p. (calculated on the scantling) suffers a quite serious reduction, as also for the B.T. calculations for crank shafts, etc. If, on the other hand, the machinery is specified to pass Board of Trade rules, the extra expense and the additional weight to be carried is quite a considerable item. For the main boilers of standardized vessels the main point that appears to me essential is that furnaces and tubes should be standardized into certain groups of sizes. For instance, based on a w.p. of 180 lbs.

Furnaces might be standardized on certain diameters, as 38, 40, 42, 44 in., etc., with length to correspond to an agreed practice, and the back ends—preferably of the withdrawal type for easy renewal, as now in general practice. It would not be necessary to arbitrarily specify Gourley-Stephen or Ashlin type flues, although the latter offers a simpler —and possibly cheaper—fitting. The important thing is that a maker could stock ready—or ready to complete to templates —a minimum of standard sizes. Then the difficulty of getting flues for new or renewal requirements would save enormously in time. Neither would the make of furnace—particularly of the ribbed or corrugated type—matter if the ends were to a standard fitting. As things are at present, the furnaces (or flues, as makers class them) are to every conceivable length and fraction of diameter.

On this head one might draw attention to the objection (in practice) of large diameter in furnaces. When these get up to 48 in. in diameter the tendency to distortion and sagging is very marked, and particularly on long voyages. With furnaces not exceeding 44 in. diameter this tendency is greatly reduced. There is rarely any trouble with flues of, say, 42 in. diameter. It is a moot question whether four furnaces of small diameter is not much better than three of large diameter, notwithstanding the usually accepted objection on the score of firing, or of single or conjoined combustion chambers. The fact remains that there is a very large amount of furnace renewal. and that not on account of age, nor often due to actual neglect.

Tubes naturally fall into the same line of reasoning, and if these were required within certain standards of length and diameter, makers could afford to stock such sizes in advance of requirements without doubt as to their saleability. The present practice of cramming in mere theoretical heating surface might be better considered in the light of larger diameter of boiler, with freer circulation and ease of access for examination and periodical cleaning. For stay tubes it is most desirable—particularly from the owner's point of view—that the diameter and pitch of the screw threads should be standard to the maker's taps, which latter are then available for use when renewing.

Stays in combustion chamber walls should be considered and so arranged that cleaning is facilitated. It is not unusual to find—through bad draughtsmanship—that odd stays are so put in as to prevent proper slicing of the combustion chamber backs and sides. The swell of tubes at the front ends should never be less than ⅛ in. It facilitates withdrawal of odd tubes and the fitting of new ones.

Furnace fronts should be standardized with balanced doors—now almost general practice—as hinged doors require constant repair after a certain time, and give more trouble to the firemen—particularly when the ship is rolling badly.

Manhole doors should be 16 in. by 12 in., both top and bottom. A stout man cannot get through a 14 in. by 10 in. orifice — except perhaps stripped — and boiler examination suffers accordingly if the chief is portly. It would be much better if all manholes were fitted with saddles. The doors could be then well fitted, and when wastage occurs such saddles are renewable.

Donkey Boiler

This is an auxiliary of the very first importance. I have nothing more to remark than that this boiler is—in five cases out of six—inadequate to its requirements. Unless this boiler is of *ample* size for all the demands that may and will be made upon it, its cost may as well be saved, for with insufficient steam the modern requirements of discharging cargo will demand a main boiler to be on. With a two-boiler job a donkey boiler is almost imperative, but with three or more main boilers I have practically come to the conclusion (rather reluctantly, I must confess) that a donkey boiler can be dispensed with, for the demand of eight winches and the other auxiliaries—pumps, dynamo, etc.—requires a boiler as large as the main.

Funnels

The *maximum* of height is usually controlled by the headroom of the Manchester Ship Canal, viz., 72 ft. above the *ballast* load line. The efficiency and constancy of draught of funnel is continually impaired by firing. In a nine-furnace job *one* furnace door is more or less always open for attention to the fires, and for quite an appreciable time when cleaning a fire. It is worth consideration whether a funnel to *each* boiler would not be good in practice. Only the draught of *one* boiler would then be influenced by the opening of fire doors in the rotation of attendance to the fires. The smoke-box arrangement would be simplified, and the weight on foundation plates reduced. Instead of one 8 ft. diameter funnel, three of 4½ ft. diameter (with three boilers abreast) would give proportionate area, the wing funnels forming derrick posts for the bridge and for bunker hatches.

Smoke-box doors badly require re-designing and strengthening to prevent buckling. The principle of angle-iron framing should be on both the door and the opening.

Fire-Bars.

These might easily be to a series of lengths, with ends all to standard. At present fire bars vary in length by fractions of inches, and end fit to every conceivable angle and form. Properly standardized, stocks could be kept by foundries in the principal ports, and plain bars obtained ex stock. The grooved fire bar is to be recommended.

Stokehold plates of cast iron could well be standardized to one size for the front of the boilers; say plates 2 ft. 6 in. square, and the marginal or fitted plates templated in the usual way and of wrought iron. As to whether the bearers should pleasure of Mrs. Connolly, wife of the be of angle iron or wood is immaterial to standardization. It is always desirable that a wood flooring be laid under cast-iron plates.

Ventilation.

There is not an engineer in the mercantile marine who will not subscribe to the verdict that in 90 jobs out of 100 the ventilation of the engine-room is totally inadequate. In most cases the centre of the stokehold space will show a lower temperature than the engine-room platform. There is no reason whatever, except dollars and cents, that it should be so, or that men should have to do duty—especially in hot weather or climates—where so much unnecessary fatigue and discomfort could so easily (in the original design) be obviated. A similar stricture may be added *re* the ventilation of bunker spaces.

Water-tight Doors

It is within the scope of the machinery department to mention the water-tight doors usually found in the stokehold bulkhead for access to reserve bunkers, and the door controlling the funnel entrance. These former are too frequently of such small dimensions as to make passage difficult for a man, and impossible for a barrow. There is no reason why such doors should not pass the usual iron wheel barrow, i.e., a width of 24 inches and the proportionate height would make access to the bunkers easy. The tunnel door is governed by (a) access to tunnel; (b) for withdrawal of condenser tubes. When the latter is the main factor in regard to size it is an ample opening, but otherwise it is too frequently inconveniently small.

Fire Extinguishing

It is within the scope of this paper, as relating to the machinery department, that this important point should receive consideration. I do not think I put it too strongly when I say that the present arrangement is totally inadequate. Every steamship is fitted along one side—usually close up under the main rail—with a 2 in. —2½ in. water service pipe, nominally for washing deck. Now, fires on shipboard are usually—when serious—caused by fire in the cargo (either by heat or spontaneous combustion, or by design), and the essential requirements in water is not *force*, but quantity. The present arrangement is sufficient for an outbreak of fire in a forecastle, but for an efficient fire service I suggest, as a minimum, a separate pipe line from end to end of the bridge space of (say) 4 in. diameter in a 2500 tonner to a 6 in. pipe in a 10,000 ton deadweight steamer.

At *each* end of the bridge space, or island, two, three, or four connections for 3 in. hoses, according to the size of ship. The 3-in. canvas delivery hoses to be each in length equal to the length of the foredeck or the after-deck — whichever is longest; the supply to be from the main ballast pump — taken off the discharge pipe, same having a spring-loaded discharge valve on ship's side to act as relief valve. The bridge space in the type of vessel we are considering is usually a bunker space. Such an arrangement would be the minimum of expense with the maximum of supply, and proportionate to the size of hold compartments and of ballast pump. The present arrangement, supplied by the general service, or feed pump, would remain as a small supply, but of greater force.

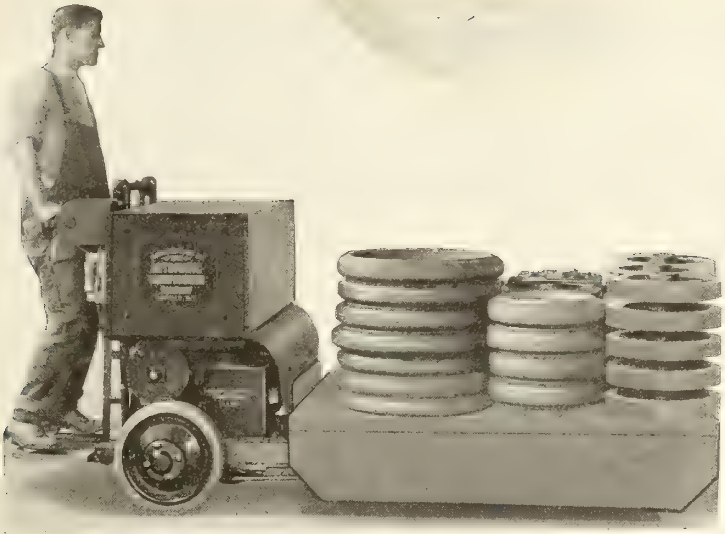
Deck machinery quite properly belongs to the subject of this paper, but it is of sufficient scope to require a paper to itself, and some criticism on windlasses, winches, steam-steering gears, and the necessary steam and exhaust piping and distribution of same, together with feed tanks, auxiliary condenser, etc., would be of great interest to those of us who go down to the sea in ships and repair and maintain the same.

Spares and Renewals

I am an advocate, and prefer in practice to order all spares and renewals from the original makers. This is only possible, and practicable, when such makers' standardize and keep a proper record of sizes and designs. For that reason (spares and renewals) it is important to specify auxiliary machinery and fittings from firms of repute, and not from casual manufacturers — and particularly not from foreign firms who do not manufacture in this country. For the success of a standardized engine, firms should agree upon a fair and equitable charge for component parts required from time to time for spares or renewals. At present, as I have found from experience, charges vary enormously for similar items, and when prices were asked in pre-war days I have known them vary from 33⅓ per cent. to 50 per cent., and even more, for the same item. From the builder or maker of any ship or engine the owner—whether original or otherwise—should expect, and receive, the best consideration.

Finally, if some such standardization and allowances for maintenance could be arrived at by a joint committee of engine builders and classification surveyors it would simplify the whole question of specification detail, and secure to the superintendent—on his owner's behalf—those extras and allowances against wear and tear that the practical man feels justified by experience in providing for—on the present basis of specification—more particularly with some firms than with others. The whole gist of my paper is not design, but such conditions of machinery that stability, reliability, and economy may be the outcome of a standard marine engine.

Recalls Old Days. — The first wood ship of its kind built in the vicinity of Quebec City since the early days of sailing vessels, when the shipbuilding industry flourished there, was launched on October 28 from the shipyard of the Quebec Shipbuilding & Repair Co., at St. Lament, Island of Orleans. The vessel is four--masted, is equipped with auxiliary power, and is of the following dimensions: Length over all, 223 ft., beam 42 ft.; depth of hold 20 ft. The deadweight carrying capacity is about 2,100 tons. The launching ceremony was performed without a hitch, the naming of the vessel Martin Connolly being the local representative of the company, the headquarters of which are in Montreal.



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If you Operate or Build Shipping you will want the most efficient equipment for the transportation of materials between handling points.

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ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Admiral Frederick R. Harris, chief of the Navy Bureau of Yards and Docks, was named on November 24 to succeed Rear-Admiral Capps as general manager of the Shipping Board's Emergency Fleet Corporation.

Michael McAuliffe, pioneer dredging contractor, died at Welland, Ont., on November 11, aged 73 years. He was at one time a member of the Weddell Dredging Co., and in more recent years of the Manly Dredging Co., his contracts extending from Chicago along the lakes to the Lower St. Lawrence.

Captain William McNeill, formerly commander of the Anchor-Donaldson Line steamship Letitia, and commodore of the Donaldson Line, died in Glasgow, Scotland, during the present month. He was one of the most popular captains in the Glasgow to Canada passenger service, and in the course of his twenty-four years' connection with the Donaldson Line had commanded the company's vessels Warwick, Lakonia, Amarynthia, Athenia, and Letitia.

Reuben G. Lunt, a pioneer shipbuilder, ship-owner and electrical engineer, and a former resident of Toronto, passed away on Nov. 19 at his residence in Los Angeles, Cal., at the age of 97 years. From 1878 to 1880 Mr. Lunt was part owner of the Rothesay and the St. John, two vessels which plied regularly between Toronto and Lewiston and Niagara-on-the-Lake. Mr. Lunt had the contract for the first electric lights ever used in the city of Toronto, and in the early eighties he exhibited equipment of the first electric railway system ever operated in this part of the country at the Toronto Exhibition. The late Mr. Lunt was a native of St. John, N.B.

More Trawlers Launched.—Two more steel trawlers were launched from the Polsons Iron Works, Toronto, on November 26. Although no invitation were issued, a large number of persons were present to witness the ceremony, which took place without mishap. The engines and boilers are ready to be fitted up immediately, and it is anticipated the boats will be able to pass down the St. Lawrence before navigation closses.

Concrete Keel Blocks.—The Ayrshire Dockyard Co., Irvine, Scotland, manufacture an arched keel block of reinforced concrete which overcomes the great difficulty experienced at the present time of obtaining wooden keel blocks. A concrete block can be made by one man in about one hour, and after being allowed to harden for several days it is ready for use; its cost is about one-third that of a wood block of the same height, and it combines great strength with a light weight. The concrete block, further, has a longer life than the wood one.

LICENSED PILOTS

ST. LAWRENCE RIVER

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

ASSOCIATIONS

DOMINION MARINE ASSOCIATION

President—A. A. Wright, Toronto. **Secretary**—Francis King, Kingston, Ont.

GREAT LAKES AND ST. LAWRENCE RIVER RATE COMMITTEE

Chairman—W. F. Herman, Cleveland, Ohio. **Secretary**—Jas. Morrison, Montreal.

INTERNATIONAL WATER LINES PASSENGER ASSOCIATION.

President—O. H. Taylor, New York.
Secretary—M. R. Nelson, 1184 Broadway, New York.

SHIPPING FEDERATION OF CANADA.

President—Andrew A. Allan, Montreal; **Manager and Secretary**—T. Robb, 218 Board of Trade, Montreal; **Treasurer**, J. R. Binning, Montreal.

SHIPMASTERS' ASSOCIATION OF CANADA.

Secretary—Captain E. Wells, 45 St. John Street, Halifax, N.S.

GRAND COUNCIL N.A.M.E. OFFICERS.

A. R. Milne, Kingston, Ont., Grand President.
J. E. Belanger, Bienville, Levis, Grand Vice-President.
Neil J. Morrison, P.O. Box 238, St. John, N.B., Grand Secretary-Treasurer.
J. W. McLeod, Owen Sound, Ont., Grand Conductor.
Lemuel Winchester, Charlottetown, P.E.I., Grand Doorkeeper.
Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

Vessels Lost "Without Trace."—In the House of Lords, on November 22, Admiral Lord Charles Beresford (retired) called attention to the increasing number of ships that are "missing without trace," and to the disclosure in the communications of Count von Luxburg, former German Minister to Argentina, of Germany's plans for the sinking of vessels in this manner. Lord Lytton, Civil Lord of the Admiralty, replying to Lord Beresford, said that, in the three years ending with October last, 122 vessels had been lost "without leaving a trace." The normal average in peace times, he added, was fifteen vessels yearly. As the result of careful inquiry, Lord Lytton added, he had no reason to believe that such disasters were increasing.

Big Ship Merger on Great Lakes.—Virtually all of the bulk freight ships on the Great Lakes, a fleet of approximately 400 ships carrying ores, coal and grain on the five inland seas, will be "mobilized" next season under one management. The Lake Carriers' Association on approval so far of members holding 85 per cent. of the tonnage represented in the organization, has voted for the mobilization. The association's members own or control more than 90 per cent. of the bulk tonnage on the lakes. The committee which will have in charge the operation of the large fleet has been unanimously chosen, and this winter will outline in detail its work for the 1918 season.

1917 Directory of Subordinate Councils, National Association of Marine Engineers.

Name.	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince,	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
Montreal,	5	Eugene Hamelin,	Jeanne Mance Street	O. L. Marchand,	93 Fifth Avenue, Lachine, P.Q.
Victoria,	6	John E. Jeffcott,	Esquimault, B.C.	Peter Gordon,	808 Blanchard St.
Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
Charlottetown,	15	J. A. Rowe	176 King Street	Chas. Cumming,	27 Easton St.
Twin City,	16	H. W. Cross,	136 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

Marine News From Every Source

Kingston, Ont.—The steamer Turbinia, which has been used in the passenger trade between Toronto and Hamilton for some time, was in port here recently, on her way to the coast, where she will be used for special work.

British Shipbuilding Council. — The British Admiralty recently announced that the formation of a shipbuilding Council had been approved and that it will be operated under the chairmanship of the Admiralty Controller.

Montreal Shipbuilders Ltd., have been incorporated at Ottawa with a capital of $300,000 to build and repair ships of all kinds at Montreal. The incorporators are Earl M. Macdougall, John B. Henderson and Leslie G. Bell, all of Montreal.

No Longer a Menace.—The masts have been removed from the wreck of the schooner George A. Marsh, which sank in Lake Ontario on August 8 this year. The hull lies in 85 feet of water, between Pigeon and Amherst Islands, and is no longer a menace to navigation.

Through Snow to the Sea.—Two vessels left the Thor Iron Works, Toronto, on November 23 to bunker, preparatory to their trip to sea. The larger boat was the Angouleme, an all-steel freighter of 4,300 tons, and the other an all-steel trawler about 125 feet long.

Salving "Graham" and Cargo.—Salvage work on the steamer Graham is proceeding satisfactorily. The vessel will be temporarily patched, and will in all likelihood be brought to Sarnia for permanent repair and outfitting. Practically all of her grain cargo has been saved.

J. H. Pouliot, manager of the Gaspe & Baie des Chaleurs Navigation Co., owners of the coasting steamers Gaspesian and Percesion was drowned at Quebec on October 30, by falling into the water between the wharf and the first-named vessel. The body was recovered the same evening.

Shipbuilding Plant for Toronto.—The Dominion Shipbuilding Co. has accepted a lease on very favorable terms from the Toronto Harbor Commissioners with a view to the establishment of a shipbuilding plant on a large scale. A site of over 15 acres has been secured within the new bulkhead of the harbor between Spadina Avenue and Queen's Wharf.

"Price" Wreck Sold. — Underwriters have sold the steamer Charles S. Price, which was lost in Lake Huron in the great storm of November 8-11, 1913, to Canadian interests for $30,000. The Price, which was owned by M. A. Hanna & Co., is on the bottom, about eleven miles above Port Huron.

The Davie Shipbuilding Co., Levis, Que., has obtained the contract for six more military barges. These vessels will be 130 feet long and will furnish work for 600 men throughout the winter. Two military barges are at present in course of construction at the Davie works.

All U.S. Lake Boats for the Atlantic.—A report from Sault Ste. Marie, Mich., states that it was recently announced by a prominent official of the United States Engineering Department that all Government boats now in northern waters are to be withdrawn immediately and placed in the Atlantic service.

Tugs for Coast Service.—The W. B. Sanders, first of ten steel tugs to be taken over by the United States Shipping Board for coast work, has gone to a shipyard to be fitted for salt water service. All the boats will be sent to the coast before the close of navigation. The Sanders is a powerful boat, and was owned by the Kelly Island Lime & Transportation Co.

St. Johns, Nfld.—It is the intention of the Newfoundland Government to submit to the Legislature at its next session a bill to limit the class of vessels entitled to bounty from the Government under the present shipping bounty law. Hereafter bounty will be payable on vessels not exceeding 120 tons gross measurement. Vessels exceeding 120 tons gross will not qualify for any bounty whatever.

Scythes & Co., Toronto, have extended the scope of their business by equipping a workshop on Church Street, Toronto, for making and repairing nautical instruments of all kinds. They have an up-to-date plant which will be a great convenience for vessel owners. The instruments manufactured will include among others, liquid and dry compasses, Kelvin pattern, sounding machines, etc.

North Vancouver Wants Drydock.—The council of the city of North Vancouver has taken a decided stand in favor of a Dominion government-constructed drydock on Burrard Inlet, and in a memorial prepared by Mayor Vance and which received the assent of the council, the Federal authorities are to be asked to undertake immediately the building of a drydock on the north shore as a Government undertaking.

Use Locust Wood for Ships.—The war has brought to light an unusual industry in Columbia County, south of Spokane. Locust trees are being cut and from them are manufactured wooden nails, used in the construction of ships for the Government. One controller has orders for more than 300,000 of these nails, which vary in length from a few inches to two and one-half feet. Locust trees are said to make a nail superior even to oak.

Projecting Broken Spar Discovered.—Information has been received of the discovery of a broken spar projecting four and one-half feet above water, about midway between Morden Rock and Maganetawan Ledges gas buoy, east side of Georgian Bay, in latitude north 45 degrees 42 minutes 40 seconds, longitude west 80 degrees 42 minutes 30 seconds. The spar is apparently the top of the mast of a vessel that was equipped with radio apparatus. A white flag has been nailed to it.

Freighter War Honour Launched.—The steel ocean-going freighter War Honour was launched from the Wyandotte Yard of the Detroit Shipbuilding Co. on November 3. The vessel was constructed under an order placed by British shipping interests, but was recently taken over by the United States Shipping Board. The steamer is of full Welland Canal size and will have a carrying capacity of about 3,000 tons. It is expected that she will be completed ready to start for the Atlantic coast before the end of the present month.

Collision and Sinking.—The steamer James S. Dunham, downbound with iron ore, was sunk in the night of November 5 through collision with the steamer Robert Fulton, upbound, off Grassy Island, on the Detroit River about 10 miles below Detroit city. The Fulton remained afloat. The wheelsman on the Dunham was killed, and her mate injured. The Dunham was a steel vessel of 8,000 tons register, and of about 420 ft. long. Her owners are Sullivan & Co., Chicago. The Fulton is owned by the Pittsburgh Steamship Co. of Cleveland, Ohio.

Mahone Bay, N.S.—McLean Brothers shipyard has been leased to Montague Mahaffy and the yard is now being extended so that three ships can be built at once. A new mill has been erected, and heavier machinery and air compressors for driving pneumatic tools have been added. The class of vessels to be built is the fast sailing West In-

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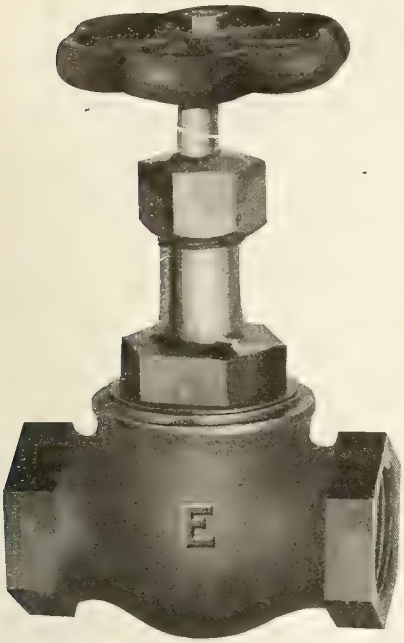

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We manufacture a full line of steam, ship and marine brass goods, valves, checks, stop cocks, three-way valves, globe, angle and gate valves. Every type and style that is required on either shipboard and engine room.

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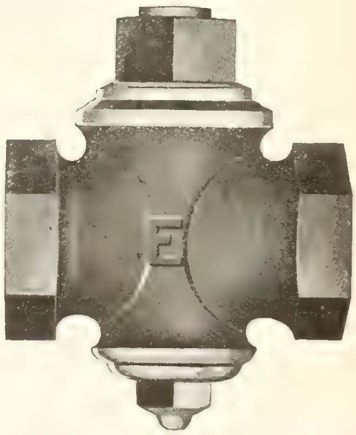
Every valve made by us bears the letter E. Look for the letter E when you want Excellency of Quality and Service.

Our ground key work is dependable. "It's made right to stay tight." We make all kinds, round way or flat, to suit every purpose.

EMPIRE VALVES are full weight through and through, and are of uniform thickness.

Some valves look good, but they lack the weight to make them substantial. The first opportunity that presents itself to examine a valve bearing the Empire E, notice the close-grained metal it is made of.

Write us about your requirements. We can furnish the goods that will give the service in and out of port and all the time.



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dian, freighter type—the ships will have three masts, will be schooner rigged and have gasoline engines for hoisting the anchors, sails and cargo. The first vessel is well under construction and the keel is now being laid for a larger ship.

Storm Signal Station Established.—Notice is given by the Department of Marine and Fisheries, Ottawa, that a storm signal station has been established 80 feet southwest of Cabot Head lighthouse, west side of Georgian Bay. The bearings of the station are:—Lattitude north 45 degrees 14 minutes 45 seconds; longitude west 81 degrees 17 minutes and 25 seconds. Storm signals will be hoisted on an arm projecting from a steel skeleton framework tower sixty feet high. The tower is square and has sloping sides. The signals are visible from all points of approach by water.

Western Star Salved.—Assisted by the Great Lakes tugs Kentucky and A. W. Colton, the steamer Western Star left Ecorse on October 8, for Toledo, where repairs will be made of the damage sustained by the freighter on Robertson's Rock, Georgian Bay. The Western Star was salvaged recently by Captain Alexander Cunning, wrecking master of the Great Lakes Towing Co., after she had hung on the rocks for two years. She was sold by the underwriters some time ago to the Valley Camp Steamship Co. for $358,000. It is estimated the necessary repairs will cost $100,000 to $150,000 additional.

Nineteen Ships for Coast.—Thirteen Great Lakes steamers owned by American shipping interests, and six ships of the Canada Steamship Lines have been ordered to the coast. The six ships of the latter are:—H. M. Pellatt, J. H. Plummer, Beaverton, A. E. Ames, Mapleton and Saskatoon. The thirteen American ships are:—America, Minnesota, Codorus, Mahoning, Northern Queen, Northern Light, Northern Wave, Northern King, North Wind, Tuscarora, Seneca, Bethlehem and Saranac. The thirteen ships, having a gross tonnage of 32,768, will be cut in two in drydock and made ready for the trip through the Welland Canal.

Niagara Falls, Ont.—The after-section of the steamer North-west recently passed through the Welland Canal. This craft was for a number of years the most palatial steamer on the Great Lakes, and was built for the late J. J. Hill at a cost exceeding $1,000,000. She is en route to the Mediterranean Sea to go into service as a hospital ship. It was thought that some some trouble would be experienced in getting her through the canal, but the locks were successfully passed. She is the widest boat so far taken through the canal, and if the experiment is successful other boats of the same beam will be taken over by the United States Government.

Yarmouth, N.S.—Two more shipbuilding companies have been organized in the Municipality of Clare, Digby County. One at Saulnierville is known as the Acadian Shipbuilding Co., with F. E. Comeau as president. The other, the Comeau Shipbuilding Co., is located at Comeauville, where they have just completed a mill which will be fitted with modern machinery. A large proportion of the stock of this company is controlled by the Clare Shipping Co. At Meteghan River, just south of the bridge, a New York concern has taken up property for shipbuilding purposes. They have erected two large mills on the premises, and they propose to commence building operations as soon as the necessary machinery is received.

Permanent Harbor Headline is Made.—An Order-in-Council has been passed at Ottawa establishing a permanent harbor headline on the south shore of the Fraser river opposite New Westminster, beyond which no wharves may extend from Port Mann to the Government wing dam at Annieville bar. This harbor line was determined on resolution of the New Westminster Board of Harbor Commissioners, recommended by the chief engineers of the Public Works and Marine Departments, and is concurred in by the Minister of Public Works and Marine. Plans and a description are on file at the office of C. C. Worsfold, resident engineer of the Public Works Department, Post Office Building, New Westminster.

Oil-Burners Must Use Coal.—Increased demand for fuel oil in the war on the Atlantic, which makes the liquid much less plentiful than on the Pacific Coast, has resulted in a decision to remove oil burners from the Cunarder War Viceroy and convert the furnaces into coal burners. The ship is now in the north, and as soon as it returns to its home port the change will be effected. Conditions are now practically the reverse to what they were a few years ago, when many of the steamship lines were outfitting their coal-burning vessels with facilities for using oil as a power medium. In view of the war conditions, it is thought that all of the steamers building on the Pacific Coast that are intended for service on the Atlantic will be coal burners, while the wooden vessels in the Pacific will use oil.

Building Sternwheelers at Yarrows.—The steel sternwheelers which have been built for delivery in India by the Esquimalt branch of Yarrows, Ltd., have given such satisfaction that another contract for a vessel of similar type has been placed with the concern by another company. Yarrows, Ltd., is already working on a contract for four sternwheelers, two having been finished and put into service, while the other two are under construction. After being fully assembled at the Esquimalt yards and placed in readiness for the water, the vessels, which are of extremely light draught and practically flat-bottomed, are "knocked down" and the parts shipped to the Orient, where they are re-assembled and put in running order again. They are used almost entirely for river navigation. The latest contract is for a vessel 185 feet long, with a 37-foot beam.

Great Lakes Shipbuilding.—The Emergency Fleet Corporation has placed a contract for thirty-six 3,500-ton ocean-going boats with the American Shipbuilding Co., instead of with Robert Dollar. The boats will be 261 feet long and 43 feet beam. The contract price is reported to be $700,000 for each, or a total of $25,200,000. Construction will be carried out on the Great Lakes and deliveries will be made next July or August. At its South Chicago plant, the American Co. is building additional ways, which will give it a total of six berths in the near future. The United States Government has authorized the Groton Iron Works of New London, Conn., to extend $3,000,000 in expanding its plant, which is to be utilized in the construction of steel and wooden merchant boats for the Emergency Fleet Corporation. Purchases of tools are being made for installation at the New London shops.

Mobilization of Tonnage.—At a meeting of the Lake Carriers' Association on November 8, at which most of the bulk freight fleets were represented, a large majority voted in favor of mobilizing the tonnage. The members present represented all but 1,429 of the 20,121 shares of stock in the association, and the vote showed that owners holding 17,081 shares are in favor of the plan, and owners of 1,610 shares voted "no." An executive Committee of five members will handle the fleet. Shippers and independent owners will be represented on the committee, which will consist of managers. Under the new plan, owners will direct the movements of their vessels very largely as heretofore, and the pooling, it is figured, will greatly improve despatch and to a very large extent do away with bunching freighters at loading and unloading ports. That will greatly increase the capacity of the fleet, and make better operation. The question of carrying charges on grain after Nov. 30, including storage cargoes, was referred to the committee, which fixed the rate for loading to Nov. 30. An advance will be paid on cargoes loaded after regular insurance expires. The committee will make recommendations along that line.

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No. 134 "Presto" Adjustable Bevel Ship Band Saw.
With power feed from 57′ to 90′ per minute.
Wheels 42″ diameter.
Angles 45° to left.
And 10° to right

THIS machine was developed by us to meet the requirements of the Wooden Shipbuilding Trade for a machine of its kind and to do away with the necessity of shipbuilders going outside of our own Canada for such a machine. The Imperial Munitions Board at Vancouver have 4 of these machines in their different plants, and here is what they say:

> **"The 'PRESTON' saws are very satisfactory and will be requisitioned and supplied if our equipment has to be increased in the future."**

Don't be afraid of it as we have also supplied about 2 dozen machines in N.S., N.B. and Newfoundland, and they are all giving satisfaction.

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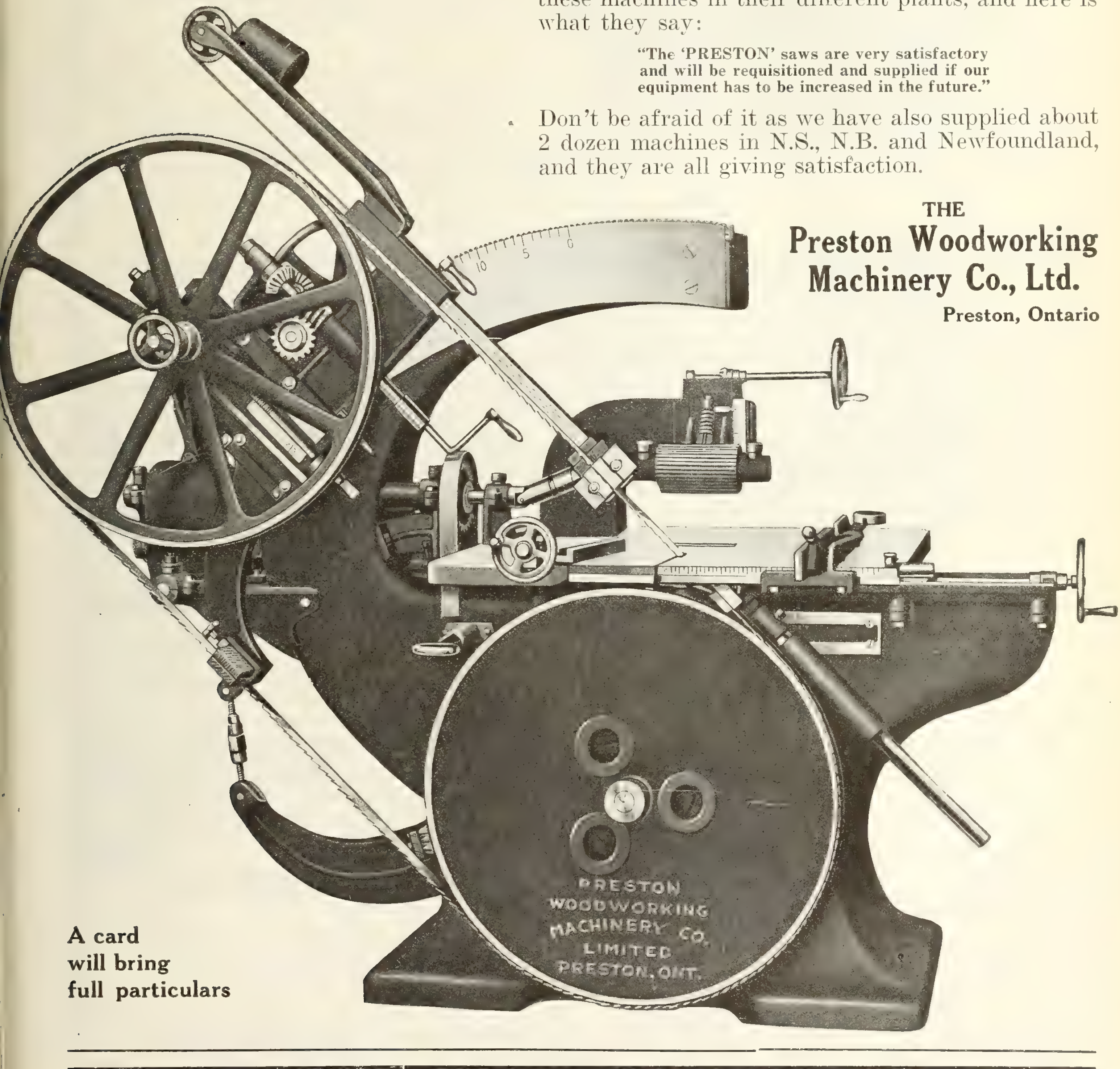

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Air tools for driving drift bolts, treenails, spikes, etc., in wooden ship building, have come to stay, because they reduce costs and hasten deliveries. Time never counted for as much in this work as it does to-day.

The Drift Bolt Driver shown in the cut is intended for up-driving. It will send home a drift bolt five feet long, 1⅜" diameter, with 1/16" drift, in hard wood in 25 seconds.

For down driving, the feed leg is replaced by a cross handle. Two men usually handle this tool, and on some classes of work can accomplish as much in one day as was formerly done in three by hand. These tools are frequently used on building construction on account of the time they save.

Other labor-savers are "Little David" Wood Borers, "Little David" Portable Saws, "Little David" Spike Drivers, Bolt Clinchers, etc. Let us tell you what can be done with these tools. Our nearest Branch Office will be glad to advise you regarding them.

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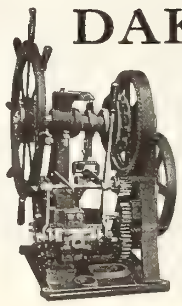

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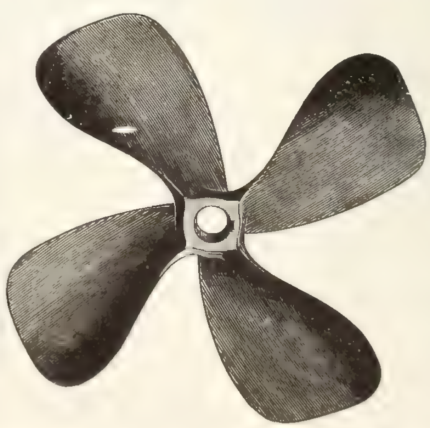

Over 30 Years' Experience Building

ENGINES AND Propeller Wheels

H. G. TROUT CO.
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226 OHIO ST.
BUFFALO, N. Y.

BUYERS' DIRECTORY

ACCUMULATORS, HYDRAULIC
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

ALLOYS, BRASS AND COPPER
Dominion Copper Products Co., Ltd., Montreal, Que.

ANCHORS
Kearfott Engineering Co., New York, N.Y.

BABBITT METAL
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.
Hoyt Metal Company, Toronto, Ontario.

BARGES
Can. B. K. Morton Co., Toronto, Montreal.
Polson Iron Works, Toronto, Ont.

BARS, GRATE
Babcock & Wilcox, Ltd., Montreal, Que.

BARS, IRON AND STEEL
Topping Brothers, New York, N.Y.

BEARINGS, BRASS
Empire Mfg. Co., London, Ont.
Murray & Fraser, New Glasgow, N.S.
United Brass & Lead Co., Toronto, Ont.

BELLS, SHIPS, ENGINE ROOM, ETC.
Aikenhead Hardware, Ltd., Toronto, Ont.
Cory & Son, Inc., Chas., New York, N.Y.
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.

BELTING, LEATHER
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.

BIBBS, COMPRESSION
Empire Mfg. Co., London, Ont.

BINNACLES
Morrison Brass Mfg. Co., James, Toronto, Ont.
Topping Brothers, New York, N.Y.

BLOCKS, CARGO, HEEL AND TACKLE
Aikenhead Hardware, Ltd., Toronto, Ont.
Loveridge, Ltd., Docks, Cardiff, Wales.
Topping Brothers, New York, N.Y.

BLOWERS, TURBO-
Can. Allis-Chalmers, Toronto, Ont.
Mason Regulator & Engin. Co., Montreal, Que.

BOILER FEED PUMPS
Can. Allis-Chalmers, Toronto, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

BOILER FITTINGS
Empire Mfg. Co., London, Ont.
McAvity & Sons Ltd., T., St. John, N.B.

BOILERS, MARINE
Babcock & Wilcox, Ltd., Montreal, Que.
Can. Allis-Chalmers, Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Doxford & Sons, William, Sunderland, England.
Goldie & McCulloch, Ltd., Galt, Ont.
Hall Engineering Works, Montreal, Que.
Jenckes Machine Co., St. Catharines, Ont.
Mason Regulator & Engin. Co., Montreal, Que.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
National Shipbuilding Co., Goderich, Ont.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.
Polson Iron Works, Toronto, Ontario.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

BOOKS, TECHNICAL, MARINE
MacLean Publishing Co., Toronto, Ont.

BOLTS
Topping Brothers, New York, N.Y.

BROKER
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Page & Jones, Mobile, Ala., U.S.A.

BUCKETS, CLAMSHELL
Beatty & Sons, Welland, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.

BUCKETS, COALING
Beatty & Sons, Welland, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.

CAPSTANS
Advance Mach. & Welding Co., Montreal, Que.
Dake Engine Co., Grand Haven, Mich.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

CALKING TOOLS
Empire Mfg. Co., London, Ont.
Topping Brothers, New York, N.Y.

CALKING TOOLS, ELECTRIC
Aikenhead Hardware, Ltd., Toronto, Ont.

CALKING TOOLS, PNEUMATIC
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

CALORIFIERS
Low & Sons, Ltd., Archibald, Glasgow, Scotland

CASTINGS
Collingwood Shipbuilding Co., Collingwood, Ont.
Jenckes Machine Co., St. Catharines, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.
The John McDougall Caledonian Iron Works Co., Montreal, Que.

CASTINGS, ALUMINUM
Empire Mfg. Co., London, Ont.
United Brass & Lead Co., Toronto, Ont.

CASTINGS, BRASS
Booth-Coulter Copper & Brass Co., Toronto, Ont.
Empire Mfg. Co., London, Ont.
McAvity & Sons Ltd., T., St. John, N.B.
United Brass & Lead Co., Toronto, Ont.

CEMENT SOLUTION
Can. Bitumastic Enamels Co., Toronto, Ont.

CHAINS
Aikenhead Hardware, Ltd., Toronto, Ont.
Kearfott Engineering Co., New York, N.Y.
Topping Brothers, New York, N.Y.

CHANDLERY, SHIP
Leckie, Ltd., John, Toronto, Ont.

CHUTES, COAL
Can. Allis-Chalmers, Toronto, Ont.

CLAMPS
Topping Brothers, New York, N.Y.

CLOCKS
American Steam Gauge & Valve Mfg Co. Boston, Mass.
Morrison Brass Mfg. Co., James, Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

COAL
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

COCKS, BILGE, DISCHARGE, INDICATOR, ETC.
McAvity & Sons Ltd., T., St. John, N.B.
Morrison Brass Mfg Co., James, Toronto, Ont.

COCKS, BASIN
Empire Mfg. Co., London, Ont.

COMPRESSORS, AIR
Can. Allis-Chalmers, Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Canadian Ingersoll-Rand Co., Sherbrooke, Que.
Jenckes Machine Co., St. Catharines, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

CONCRETE MIXERS
St. Clair Bros., Galt, Ontario.
The John McDougall Caledonian Iron Works Co., Montreal, Que.

CONDENSERS
Can. Allis-Chalmers, Toronto, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kearfott Engineering Co., New York, N.Y.
Morris Machine Works, Baldwinsville, N.Y.
Smart-Turner Mach. Co., Hamilton, Ont.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

CONVEYORS, ASH, COAL
Babcock & Wilcox, Ltd., Montreal, Que.

COPING MACHINES
Bertram & Sons, Ltd., John, Dundas, Ont.

COPPERSMITHS
Booth-Coulter Copper & Brass Co., Toronto, Ont.

COPPER TUBES, SHEETS AND RODS
Dominion Copper Products Co., Ltd., Montreal, Que.

COVERS, CANVAS, FOR HATCHES, LIFE-BOATS, ETC.
Leckie, Ltd., John, Toronto, Ont.

COUNTERS, REVOLUTION
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

CRANES
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ont.

CRANES, ELECTRIC
Babcock & Wilcox, Ltd., Montreal, Que.
Smart-Turner Mach. Co., Hamilton

CRANES, GANTRY
Smart-Turner Mach. Co., Hamilton, Ont.

DAVITS, BOAT
Babcock & Wilcox, Ltd., Montreal, Que.

DERRICKS
Aikenhead Hardware, Ltd., Toronto, Ont.
Dake Engine Co., Grand Haven, Mich.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.

DISTILLERS
Kearfott Engineering Co., New York, N.Y.

DREDGES
Collingwood Shipbuilding Co., Collingwood, Ont.
Norbom Engineering Co., Philadelphia, Pa.
Polson Iron Works, Toronto.

DRILLS, AIR
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

DRILLS, TWIST
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

DRILLS, ELECTRIC
Aikenhead Hardware, Ltd., Toronto, Ont.

DRY DOCKS
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Doxford & Sons, William, Sunderland, England.
Georgian Bay Shipbuilding & Wrecking Co., Midland, Ont.
Montreal Dry Docks & Shipbuilding Co., Montreal
Muir Bros. Dry Dock Co., Port Dalhousie, Ont.
National Shipbuilding Co., Goderich, Ont.
Polson Iron Works, Toronto, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.
Yarrows, Limited, Victoria, B.C.

ECONOMIZERS, FUEL
Babcock & Wilcox, Ltd., Montreal, Que.

EJECTORS
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.

ELECTRO-PLATING
United Brass & Lead Co., Toronto, Ont.

ELEVATING MACHINERY
Goldie & McCulloch, Ltd., Galt, Ont.

ENAMEL
Can. Bitumastic Enamels Co., Toronto, Ont.

ENGINES, DIESEL
Can. Allis-Chalmers, Toronto, Ont.

ENGINES, HOISTING
Advance Mach. & Welding Co., Montreal, Que.
Can. Allis-Chalmers, Toronto, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

ENGINE, INTERNAL COMBUSTION
Doxford & Sons, William, Sunderland, England.

ENGINES, MARINE
Bolinders Co., New York, N.Y.
Can. Allis-Chalmers, Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Vickers, Ltd., Montreal, Que.
Doxford & Sons, William, Sunderland, England.
Goldie & McCulloch, Ltd., Galt, Ont.
Iron Works, Ltd., Owen Sound, Ont.
Mason Regulator & Engin. Co., Montreal, Que.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
Murray & Fraser, New Glasgow, N.S.
National Shipbuilding Co., Goderich, Ont.
Norbom Engineering Co., Philadelphia, Pa.
Polson Iron Works, Toronto, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Trout Co., H. G., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

ENGINES, STEERING
Dake Engine Co., Grand Haven, Mich.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

EVAPORATORS
Kearfott Engineering Co., New York, N.Y.
Mason Regulator & Engin. Co., Montreal, Que.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.

EXTRACTORS, GREASE
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

FANS
Aikenhead Hardware, Ltd., Toronto, Ont.
Empire Mfg. Co., London, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

FENDERS, ROPE
Leckie, Ltd., John, Toronto, Ont.

FERRULES, CONDENSER
Booth-Coulter Copper & Brass Co., Toronto, Ont.

FERRO-MANGANESE
Mitchells, Ltd., Glasgow, Scotland.

FILES
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

FIRE BRICKS
Mitchells, Ltd., Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

FILTERS, FEED WATER
Mason Regulator & Engin. Co., Montreal, Que.

FITTINGS, MOTOR BOAT
Empire Mfg. Co., London, Ont.
Murray & Fraser, New Glasgow, N.S.

FIXTURES, ELECTRIC
Can. General Electric Co., Toronto, Ont.
Cory & Son, Inc., Chas., New York, N.Y.

FORGES
Aikenhead Hardware, Ltd., Toronto, Ont.

FLUORSPAR
Mitchells, Ltd., Glasgow, Scotland.

FORGINGS, ALL KINDS
Aikenhead Hardware, Ltd., Toronto, Ont.
Collingwood Shipbuilding Co., Collingwood, Ont.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.
St. Clair Bros., Galt, Ont.

GAUGES, RECORDING
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Empire Mfg. Co., London, Ont.

GAUGES, WATER, PRESSURE, COMPOUND AND VACUUM
Aikenhead Hardware, Ltd., Toronto, Ont.
Babcock & Wilcox, Ltd., Montreal, Que.
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. General Electric Co., Toronto, Ont.

GENERATORS AND CONVERTORS
Can. General Electric Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co. Sherbrooke, Que.

HAMMERS, DROP AND BELT DRIVEN
Beaudry & Co., Boston, Mass.

HAMMERS, MOTOR DRIVEN
Beaudry & Co., Boston, Mass.

HAMMERS, NAIL MACHINE
Beaudry & Co., Boston, Mass.
United Hammer Co., Boston, Mass.

HAMMERS, PNEUMATIC
Barr, H. Edsil, Palace Bldg., Erie, Pa.

HAMMERS, POWER
United Hammer Co., Boston, Mass.

HEATING EQUIPMENT
Empire Mfg. Co., London, Ont.
Low & Sons, Ltd., Archibald, Glasgow, Scotland

HEATERS, FEED, WATER
Babcock & Wilcox, Ltd., Montreal, Que.
Can. Allis-Chalmers, Toronto, Ont.
Kearfott Engineering Co., New York, N.Y.
Mason Regulator & Engin. Co., Montreal, Que.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.

HOISTS, ASH
Beatty & Sons, Welland, Ont.
St. Clair Bros., Galt, Ont.

HOISTS, CHAIN
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Dake Engine Co., Grand Haven, Mich.
Topping Brothers, New York, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

HOISTS, CARGO, MOVING, ETC.
Dake Engine Co., Grand Haven, Mich.
Jenckes Mach. Co., Ltd., Sherbrooke, Que.

HOISTING MACHINERY
Beatty & Sons, Welland, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

HYDRAULIC MACHINERY
The John McDougall Caledonian Iron Works Co., Montreal, Que.

INDICATORS, ENGINE
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Cory & Son, Inc., Chas., New York, N.Y.

INDICATORS, SPEED
Aikenhead Hardware, Ltd., Toronto, Ont.
Cory & Son, Inc., Chas., New York, N.Y.

INJECTORS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Allis-Chalmers, Toronto, Ont.
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

INSTRUMENTS, NAUTICAL
Leckie, Ltd., John, Toronto, Ont.

JOINTS, BALL SLIP
Norbom Engineering Co., Philadelphia, Pa.

INSURANCE, MARINE
Toronto Insurance & Vessel Agency, Toronto, Ont.

LAMPS, ARC, INCANDESCENT
Can. General Electric Co., Toronto, Ont.

LATHES
Foss & Hill Machinery Co., Montreal, Que.
Bertram & Sons, Ltd., John, Dundas, Ont.

LIFEBUOYS, BELTS AND PRESERVERS
Fosbery Co., Barking, Essex, Eng.

LIFE BOAT EQUIPMENT
Leckie, Ltd., John, Toronto, Ont.

LIFE JACKETS
Leckie, Ltd., John, Toronto, Ont.

LIGHTS, ALL KINDS
Can. Fairbanks-Morse Co., Montreal, Que.
Morrison Brass Mfg. Co., James, Toronto, Ont.

LIGHTS, SIDE, PORT
McAvity & Sons Ltd., T., St. John, N.B.

LIGHTING SETS
Can. Fairbanks-Morse Co., Montreal.
Cory & Son, Inc., Chas., New York, N.Y.
Kearfott Engineering Co., New York, N.Y.
Williams Machinery Co., A. R., Toronto, Ont

LUBRICATORS
Empire Mfg. Co., London, Ont.

MACHINISTS
Hyde Engineering Works, Montreal, Que.

MACHINE AND FORGE WORK
Thor Iron Works, Toronto, Ont.

METERS, STEAM, WATER
Can. Allis-Chalmers, Toronto, Ont.

MOTORS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. General Electric Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ont.

NET LIFTERS
Dake Engine Co., Grand Haven, Mich.
Leckie, Ltd., John, Toronto, Ont.

NOZZLES, ALL KINDS
Empire Mfg. Co., London, Ont.

OIL CUPS
Empire Mfg. Co., London, Ont.
Murray & Fraser, New Glasgow, N.S.

OIL SEPARATORS
Can. Allis-Chalmers, Toronto, Ont.

OAKUM
Leckie, Ltd., John, Toronto, Ont.

OXY-ACETLYENE OUTFITS
Can. Fairbanks-Morse Co., Montreal, Que.
McAvity & Sons Ltd., T., St. John, N.B.
Williams Machinery Co., A. R., Toronto, Ont.

PAINT
Ault & Wiborg Co. of Can., Ltd., Toronto, Ont.
Brandram-Henderson, Ltd., Montreal, Que.
Can. Bitumastic Enamels, Ltd., Toronto, Ont.

PACKING, AMMONIA
Can. B. K. Morton Co., Montreal.
France Packing Co., Philadelphia, Pa.

PACKING, MARINE
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Montreal.
France Packing Co., Philadelphia, Pa.

PACKING, METALLIC
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Montreal.
France Packing Co., Philadelphia, Pa.

PACKING, STEAM
Aikenhead Hardware, Ltd., Toronto, Ont.
France Packing Co., Philadelphia, Pa.

PINIONS, CUT
Hamilton Gear & Machine Co., Toronto, Ont.

PIPE, LAPWELD, CAST IRON, RIVETED
Empire Mfg. Co., London, Ont.
Norbom Engineering Co., Philadelphia, Pa.

PLANERS
Bertram & Sons, Ltd., John, Dundas, Ont.

PLANERS, STANDARD AND ROTARY
Preston Woodworking Machinery Co., Preston, Ont.
Yates Mach. Co., P. B., Hamilton, Ont.

PLATE PUNCH TABLES
Norbom Engineering Co., Philadelphia, Pa.

PLATE WORK
Jenckes Machine Co., St. Catharines, Ont.

PLUMBING EQUIPMENT
Low & Sons, Ltd., Archibald, Glasgow, Scotland.
Empire Mfg. Co., London, Ont.

PROPELLOR BLADES, BRONZE
Empire Mfg. Co., London, Ont.
Murray & Fraser, New Glasgow, N.S.
Yarrows, Limited, Victoria, B.C.

PROPELLER WHEELS
Kennedy & Sons, Wm., Owen Sound, Ont.
Trout Co., H. G., Buffalo, N.Y.

PIPING, COPPER
Booth-Coulter Copper & Brass Co., Toronto, Ont.

PIPING, STEAM
Babcock & Wilcox, Ltd., Montreal, Que.

PULLEYS
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS
Can. Fairbanks-Morse Co., Montreal, Que.
Goldie & McCulloch, Ltd., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMP, AIR
Can. Ingersoll-Rand Co. Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, CIRCULATING
Kingsford Fdy. & Mach. Works, Oswego, N.Y.
Morris Machine Works, Baldwinsville, N.Y.

PUMPS, CENTRIFUGAL
Can. Allis-Chalmers, Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.
Kearfott Engineering Co., New York, N.Y.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Norbom Engineering Co., Philadelphia, Pa.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, FEED WATER
Can. Allis-Chalmers, Toronto, Ont.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, HAND AND POWER
Aikenhead Hardware, Ltd., Toronto, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, HIGH PRESSURE
Canadian Ingersoll-Rand Co., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

PUMPS, STEAM TURBO
Can. Allis-Chalmers, Toronto, Ont.

PUMPING MACHINES
Norbom Engineering Co., Philadelphia, Pa.

PUNCHES
Bertram & Sons, Ltd., John, Dundas, Ont.

PUNCHES, SINGLE, DOUBLE AND MULTIPLE
Norbom Engineering Co., Philadelphia, Pa.

PURIFIERS, WATER
Babcock & Wilcox, Ltd., Montreal, Que.
Can. Allis-Chalmers, Toronto, Ont.

RADIO ENGINEERS
Cutting & Washington, Inc., Cambridge, Mass.

RADIATORS, STEAM, ELECTRIC
Empire Mfg. Co., London, Ont.
Low & Sons, Ltd., Archibald, Glasgow, Scotland.

RECEIVERS, AIR
Can. Allis-Chalmers, Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

REGULATORS, FEED WATER
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

REGULATORS, PRESSURE
Mason Regulator & Engin. Co., Montreal, Que.

REPAIRS, MARINE
Corbet Foundry & Mach. Co., Owen Sound, Ont.
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Georgian Bay Shipbuilding & Wrecking Co., Midland, Ont.
Hyde Engineering Works, Montreal, Que.
Iron Works, Ltd., Owen Sound, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
Muir Bros. Dry Dock Co., Port Dalhousie, Ont.
National Shipbuilding Co., Goderich, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Yarrow, Limited, Victoria, B.C.

RIGGING, WIRE ROPE
Leckie, Ltd., John, Toronto, Ont.

RIVETERS, PNEUMATIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS, STRAIGHTENING, BENDING
Bertram & Sons, Ltd., John, Dundas, Ont.

ROPE BLOCKS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Thor Iron Works, Toronto, Ont.

ROPE
Leckie, Ltd., John, Toronto, Ont.

SAWS, BAND
Preston Woodworking Machinery Co., Preston, Ont.

SAW MILL MACHINERY
Preston Woodworking Machinery Co., Preston, Ont.
Yates Machine Co., P. B., Hamilton, Ont.

SCALES, BOILERS, ENGINES
Can. Fairbanks-Morse Co., Montreal, Que.

SCOWS
Collingwood Shipbuilding Co., Collingwood, Ont.
Polson Iron Works, Toronto, Ont.

SHAPES
Topping Brothers, New York, N.Y.

SEPARATORS, OIL, STEAM
Mason Regulator & Engin. Co., Montreal, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

SHAFTING, BRONZE
Empire Mfg. Co., London, Ont.
Murray & Fraser, New Glasgow, N.B.

SHEARS
Bertram & Sons, Ltd., John, Dundas, Ont.
Norbom Engineering Co., Philadelphia, Pa.

SHIPBUILDING TOOLS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

SHIPS, BUILDERS OF
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Doxford & Sons, William, Sunderland, England.
Georgian Bay Shipbuilding & Wrecking Co., Midland, Ont.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
National Shipbuilding Co., Goderich, Ont.
Polson Iron Works, Toronto, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.
Yarrows, Limited, Victoria, B.C.

SHIP BROKERS
Page & Jones, Mobile, Ala.

SHIP PLATES
Nova Scotia Steel & Coal Co., New Glasgow, N.S.
Topping Brothers, New York, N.Y.

SHIPS' TELEGRAPHS
Cory & Son, Inc., Chas., New York, N.Y.
Morrison Brass Mfg. Co., James, Toronto, Ont.

SPECIAL MACHINERY
Smart-Turner Mach. Co., Hamilton, Ont.

SPIKES
Topping Brothers, New York, N.Y.

STANDPIPES
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Thor Iron Works, Toronto, Ont.

STAYBOLTS, FLEXIBLE
Can. Allis-Chalmers, Toronto, Ont.

STEAMSHIP AGENTS
Page & Jones, Mobile, Ala.

STEAM SEPARATORS
Can. Allis-Chalmers, Toronto, Ont.

STEAM SPECIALTIES
Can. Fairbanks-Morse Co., Montreal, Que.
Empire Mfg. Co., London, Ont.

STEAM TRAPS
Aikenhead Hardware, Ltd., Toronto, Ont.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Empire Mfg. Co., London, Ont.
Mason Regulator & Engin. Co., Montreal, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

STEEL, HIGH SPEED
Can. B. K. Morton Co., Toronto, Montreal.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

STEEL WORK, STRUCTURAL
Babcock & Wilcox, Ltd., Montreal, Que.

STOKERS, MECHANICAL
Babcock & Wilcox, Ltd., Montreal, Que.

SUPERHEATERS, STEAM
Babcock & Wilcox, Ltd., Montreal, Que.

TANKS, STEEL
Jenckes Mach. Co., Ltd., Sherbrooke, Que.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.

TANKS
Corbet Foundry & Mach. Co., Owen Sound, Ont.
Goldie & McCulloch, Ltd., Galt, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.

TELEPHONES, MARINE
Cory & Son, Inc., Chas., New York, N.Y.

TREENAILS
Topping Brothers, New York, N.Y.

TROLLEYS
Can. Fairbanks-Morse Co., Montreal, Que.

TRUCKS, HAND, ELECTRIC
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.

TUBES, BOILER
Babcock & Wilcox, Ltd., Montreal, Que.

TUGS
Collingwood Shipbuilding Co., Collingwood, Ont.
Polson Iron Works, Toronto, Ont.

TURBINES, DIRECT-DRIVING AND GEARED
Can. Allis-Chalmers, Toronto, Ont.
Doxford & Sons, William, Sunderland, England.

UNIONS, ALL KINDS
Dart Union Company, Toronto, Ont.

VALVES
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Babcock & Wilcox, Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Montreal, Que.
Empire Mfg. Co., London, Ont.
McAvity & Sons, Ltd., T., St. John, N.B.
Mason Regulator & Engin. Co., Montreal, Que.
Norbom Engineering Co., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.

VALVES, FOOT
Aikenhead Hardware, Ltd., Toronto, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.

VALVES, STOP, REDUCING, SAFETY CHECK, ETC.
Aikenhead Hardware, Ltd., Toronto, Ont.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Empire Mfg. Co., London, Ont.
McAvity & Sons Ltd., T., St. John, N.B.
Morrison Brass Mfg. Co., James, Toronto, Ont.

VARNISHES
Aikenhead Hardware, Ltd., Toronto, Ont.
Ault & Wiborg Co. of Can., Ltd., Toronto, Ont.
Leckie, Ltd., John, Toronto, Ont.
McAvity & Sons Ltd., T., St. John, N.B.

VENTILATION EQUIPMENT
Empire Mfg. Co., London, Ont.
Low & Sons, Ltd., Archibald, Glasgow, Scotland

WATER COLUMNS
Morrison Brass Mfg. Co., James, Toronto, Ont.

WATER HEATERS
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.

WATER SOFTENERS
Babcock & Wilcox, Ltd., Montreal, Que.
Can. Allis-Chalmers, Toronto, Ont.

WEDGES, OAK
Topping Brothers, New York, N.Y.

WELDING, ELECTRIC
Hall Engineering Works, Montreal, Que.
Marine Welding Co., Buffalo, N.Y.
Beatty & Sons, M., Welland, Ont.

WELDING, OXY-ACETYLENE
Advance Mach. & Welding Co., Montreal, Que.

WHISTLES AND SYRENS
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., Jas., Toronto, Ont.

WINCHES, CARGO
Advance Mach. & Welding Co., Montreal, Que.
Aikenhead Hardware, Ltd., Toronto, Ont.
Jenckes Machine Co., St. Catharines, Ont.

WINCHES, DOCK, SHIP
Advance Mach. & Welding Co., Montreal, Que.
Beatty & Sons, M., Welland, Ont.
Jenckes Machine Co., St. Catharines, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.

WINCHES, TOWING
Corbet Foundry & Mach. Co., Owen Sound, Ont.
Jenckes Mach. Co., Ltd., Sherbrooke, Que.

WINCHES, TRAWL
Beatty & Sons, M., Welland, Ont.
Jenckes Mach. Co., Ltd., Sherbrooke, Que.

WINDLASSES
Advance Mach. & Welding Co., Montreal, Que.
Dake Engine Co., Grand Haven, Mich.
Jenckes Mach. Co., Ltd., Sherbrooke, Que.

WIPER CAPS, OILER BOXES, ETC.
Morrison Brass Mfg. Co., James, Toronto, Ont.

WIRELESS OUTFITS
Cutting & Washington, Inc., Cambridge, Mass.

WOOD WORKING MACHINERY
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Preston Woodworking Machinery Co., Preston.
Williams Machinery Co., A. R., Toronto, Ont.
Yates Mach. Co., P. B., Hamilton, Ont.

WOOD BORING TOOLS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co., Sherbrooke, Que.

INDEX TO ADVERTISERS


TRADE MARK J.M.T. A GUARANTEE OF QUALITY
MORRISON'S
Steam Goods and Specialties
Morrison's products have a clean record of success in the power houses of Canada covering a period of nearly two score of years. They represent the highest quality and the most modern designs in their line.
Approved by Dominion and Provincial Government inspection. All goods thoroughly tested before leaving factory.
Stop Valves
Safety Valves
Inspirators
Jet Pumps
Boiler Mountings
Vacuum Gauges
Gauge Boards
Check Valves
Relief Valves
Injectors
Steam Traps
Gauge Cocks
Recording Gauges
Oil Cups
Gate Valves
Reducing Valves
Ejectors
Water Gauges
Pressure Gauges
Ammonia Gauges
Lubricators
Lumber Measuring Machines
Packing Tools and Supplies
Pipe and Fittings
J.M.T. Reducing Valve Will Not Equalize.
"BEAVER" Combined Stop and Check Valve
Straightway Radiator Valve
J.M.T. Gate Valve
Gem Ejector
Model "C" Safety Valve
Gate Valve
Pressure Gauges and Recording Instruments
James Morrison Brass. Mfg. Co., Ltd.
93-97 Adelaide Street West - - Toronto, Canada

CIRCULATES IN EVERY PROVINCE OF CANADA AND ABROAD

MARINE ENGINEERING of Canada

A monthly journal dealing with the progress and development of Merchant and Naval Marine Engineering, Shipbuilding, the building of Harbors and Docks, and containing a record of the latest and best practice throughout the Sea-going World. Published by
The MacLean Publishing Co., Limited
MONTREAL, Southam Building TORONTO 143-153 University Ave. WINNIPEG, 1207 Union Trust Bldg. LONDON, ENG., 88 Fleet St.

Vol. VII. Publication Office, Toronto—December 1917 No. 12

The Publisher's Page

TORONTO DECEMBER, 1917

The Economy of Business Paper Advertising

By H. E. CLELAND, NEW YORK

Awarded the Higham prize at the convention of Associated Advertising Clubs, at St. Louis, June 1917. This prize is given annually to the one delivering the most constructive address in the fewest words.

(Continued from last month)

SO, in a quiet, substantial, and most-times unheralded way, the business papers are leaders of progress in their respective industries and in this character they tie to them the progressive men of the industries. Only progressive men are worth while to advertisers. Therefore, the business papers not only aim directly at those industries where the advertisers' products may be sold, but they automatically select the men in each industry whose words carry weight of buying authority. But modern business papers—those which, for instance, are members of the Associated Business Press—go even further and put before the advertiser the exact number of each classification of subscribers. So that, in a technical industry, for instance, the advertisers are shown how many firms, executive officers, purchasing agents, superintendents, engineers, etc., are on the paid subscription list and from these the advertiser may estimate the buying power which each publication holds for his product.

In other words, the business papers are helping to put advertising closer to the status of an exact science.

And that, in turn, spells greater economy in advertising.

"BUYING POWER" THE TEST.

I said that the buying power per subscription in a business paper was greater than the buying power per subscription of any other medium because things are bought for business and not private consumption.

To illustrate this, one industry last year bought approximately $500,000,000 worth of goods and 90 per cent. of this industry is covered by two business papers having a total paid circulation of 22,000, or an average of material bought per subscriber of about $20,500.

Since it is a fact that less than five per cent. of our population has an income of over $4,000 per year, it may readily be seen that private and business consumption are far, far apart.

I quote from an industry with which I am familiar and not one picked because of its exceptional buying capacity. There are probably many which exceed it.

So, the thought is that each dollar invested in business paper advertising buys more potential sales results because each appeals to a greater buying power.

And that, too, is economy in advertising.

THE POTENT THING.

Now, all of you advertising men know that the really potent thing in advertising is cumulative effect. You know that even poor and mediocre advertising, persisted in, pays and pays handsomely.

You know, on the other hand, that sporadic advertising, even of the best kind, has only a temporary effect and that effect is seldom of sufficient force to pay.

The splurger makes his splash, the ripples die out and the surface becomes calm and serene. He loses because his advertising is too costly to be kept up continuously.

THERE IS NO SUBSTITUTE FOR CONTINUITY IN ADVERTISING.

It is possible, because of the low rates in business papers, for practically any manufacturer to advertise week in and week out or month in and month out, to hammer away until by sheer force of persistence he drives his claims home and sells his prospect.

It takes time to sway men the advertiser's way. It takes repeated effort to get the first return from advertising.

The advertising catacombs are filled too full of the bones of half-tried efforts.

There are publishers who permit and agents who induce advertisers to adopt "splurge" advertising, and these I charge with the crime of high treason against the cause of effective advertising.

Advertising which cannot reap the benefits of cumulative effect is not as profitable as it ought to be. Therefore, it is not as economical as it might be.

Business paper advertising is economical because, intensive circulation permits rates low enough to allow practically any manufacturer to advertise continuously.

FOLLOW THE SALESMAN'S METHODS.

That advertising is best which comes closest to the best in salesmanship.

What does the salesman do? Assume that he is selling steam engines, does he make a house-to-house canvass of say, Chicago? Not on your life. Aside from the utter insanity of that procedure, it takes twelve years and eight months for one man to make a house-to-house canvass of Chicago. He picks out steam power plants or plants in course of design or of building and goes to those and no others.

Does he make his sales talk to the office boys and stenographers in those plants? Not in one thousand years. He goes to the man who buys or recommends.

Does he talk to these men about steam calliopes or about steam engines? You know the answer.

Does he endeavor to show the economy and efficiency of the steam engine as a prime mover and does his talk resemble that of an engineer or a chauffeur? You know the answers to that, too.

Now, why does the salesman do these things? Because the efficient salesman knows how to follow the straight line—the shortest distance between two points—and because his concern will not pay for the super-expense of roundabout methods.

For precisely the same reason, the wise manufacturer uses the business papers to carry his advertising message.

(Concluded next month)

Thor Iron Works Limited

Toronto, CANADA

OFFICE, DOCKS AND WORKS, FOOT OF BATHURST ST.

Shipbuilders

Ship Repairing, Alterations Reconstruction.

Steel Tanks, Standpipes
Machine and Forge Work

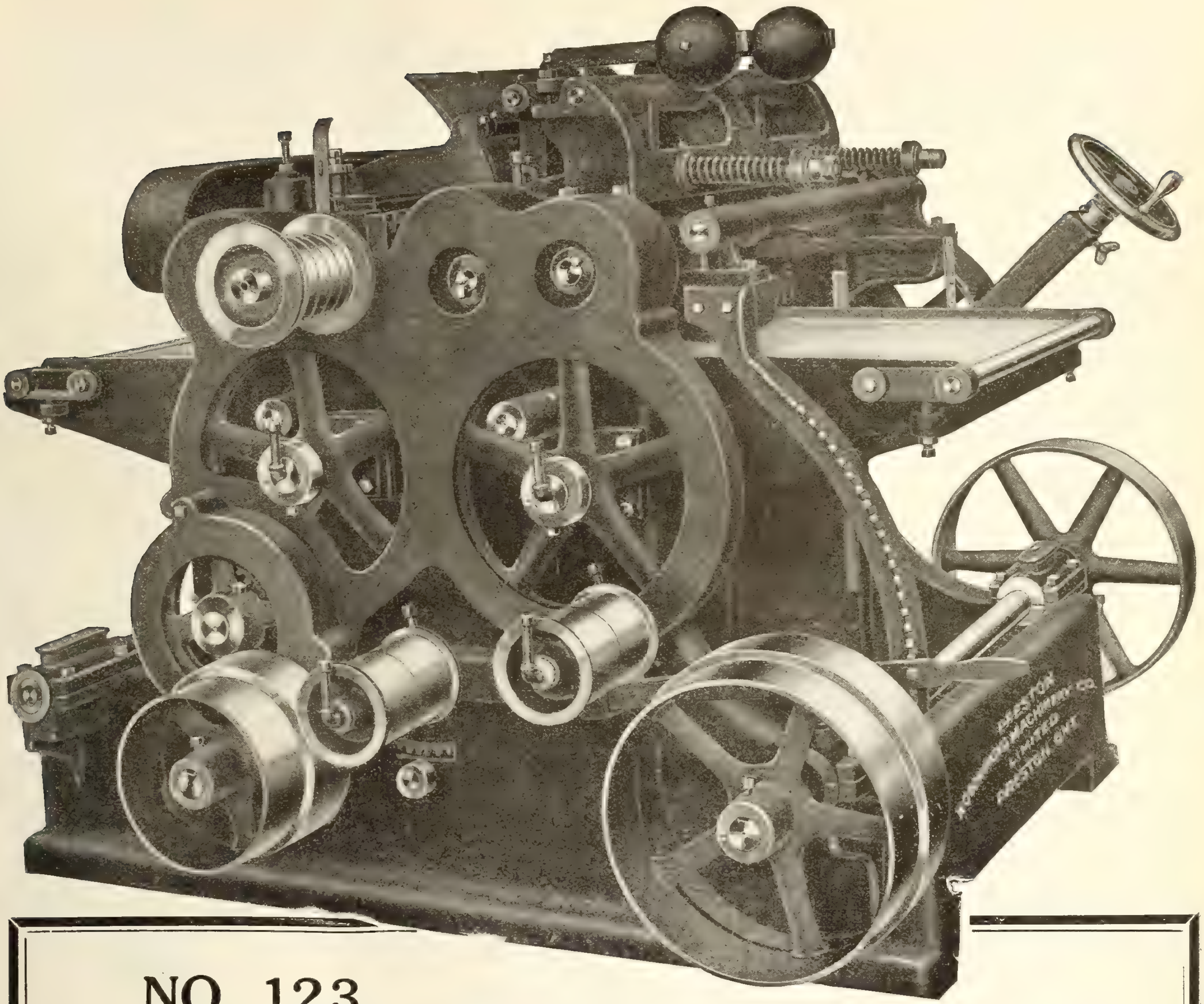
Satisfaction Guaranteed

Illustration Shows:

4300-Ton Bulk Freighter under construction. 261 ft. x 43 ft. 6 in. x 28 ft. 2 in.

New Electrically - Operated Gantry Crane, 68-ft,. Span 56-ft., Lift 20.Ton

Steel Yacht, 85 ft. x 15 ft. x 10 ft. Built for Harbor Inspector.



NO. 123

Preston Surface Planer

With Divided or Straight Roll. Planes 26 ins. and 30 ins. wide, 10 ins. thick. Long Whitney Boxes. All Gears Protected.
All Feed Rolls driven by large powerful gears.
Special attention to Lubrication. Substantial floor bearing.
Durability. Convenience. Weight. Speed.
Ask us for circular of this machine. It is a strongly built heavy machine and we commend it to Shipbuilders and any Woodworkers as being ABLE TO GO THE LIMIT and produce BEST AND SMOOTHEST RESULTS.
We recently shipped a 30-in. machine to the Department of Naval Service at Halifax, and it is giving good satisfaction.

WRITE FOR CATALOGUE

The Preston Woodworking Machinery Co., Ltd. PRESTON, ONTARIO

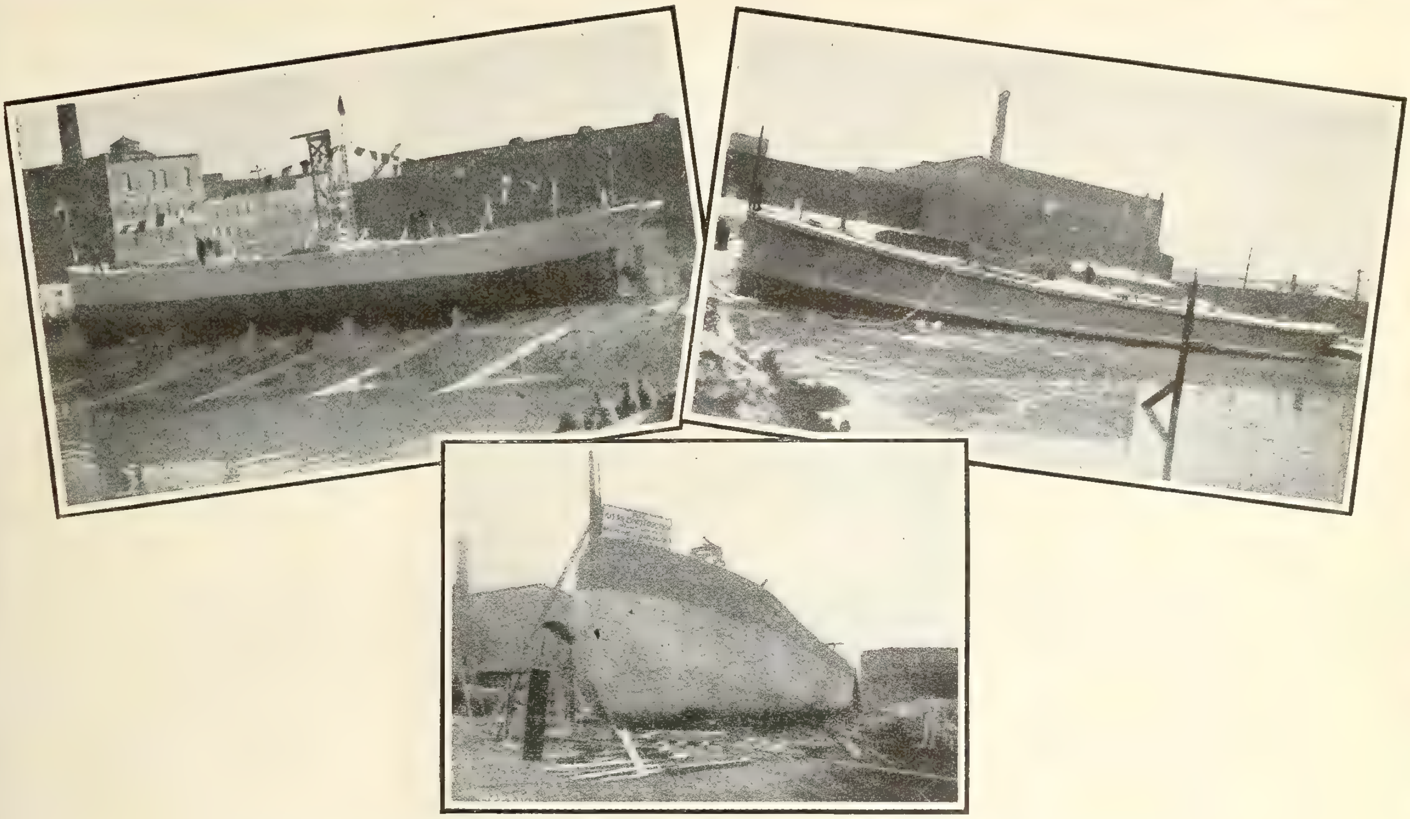


Photo of the "Concretia"—a ship built of reinforced concrete by the Atlas Construction Co., Limited, and recently launched at Montreal. The Hull Paint used on this ship was supplied by Brandram-Henderson, Limited.

B-H
Anchor
MARINE PAINTS

manufactured by a concern that has for over 30 years specialized in paint for shipbuilders, are the best for concrete, wooden or steel vessels.

Every paint required for the inside or outside of a ship is to be found in our line, which includes:

Hull Paints	**Anti-Corrosive Composition**
Deck Paints	**Anti-Fouling Composition**
Marine Zinc White	**Lower Hold Composition**
Cabin Enamels	**Engine Enamels**
Copper Paints	**Aluminum Paints**
White Lead	**Red Lead**

OUR NEW MARINE PAINT CATALOGUE

is just off the press. It is a loose-leaf catalogue of 68 pages, cloth bound, profusely illustrated. It is full of information necessary to any shipbuilder. A copy will be sent free to anyone on request.

BRANDRAM-HENDERSON LIMITED

MONTREAL HALIFAX ST JOHN TORONTO WINNIPEG CALGARY EDMONTON VANCOUVER

Staff Article

The inherent possibilities of shipbuilding and marine engineering are realized as never before in our experience, combining as they do staple industries in themselves of large proportions and the medium through which a myriad other enterprises, large and small, agricultural, mineral and manufacturing, may find opportunity to more fully expand and develop.

THE revival of shipbuilding on her lake and ocean shores has been an outstanding feature of Canada's industrial achievement during the past year. Wood as well as steel has entered largely into individual vessel construction, the former constituting the hull material not only for auxiliary powered schooners but for ocean-going steamships propelled by standard type marine engines or steam turbines as well. Needless to say, the revival is entirely due to the necessity of our aiding to offset the losses arising from German submarine activity and the otherwise abnormal demand for tonnage to maintain the world's commerce and to keep the Allied fronts supplied with both men, munitions, and merchandise.

Many new shipyards have been established all of which together with those of many years standing being taxed to capacity with orders at least twelve months ahead. Complete returns are not yet available of the year's output, nevertheless, although it will not eclipse the banner year of 1874, the tonnage for which mounted up to some 190,000 tons for 487 vessels, a reasonably close approach to that tonnage will be the ultimate record. Number of vessels will also be fewer.

Marine Engineering

Marine engine building, ship deck and engine room auxiliary machinery manufacture are lines of endeavor to which Canadian metal working plants have applied themselves as a result of the shipbuilding activity, and in each of these spheres perhaps even greater success has been achieved than in the purely ship construction feature, due to the fact that many plants specializing in more or less similar equipment for stationary or land requirements found little difficulty in meeting the specification demand for boardship installations.

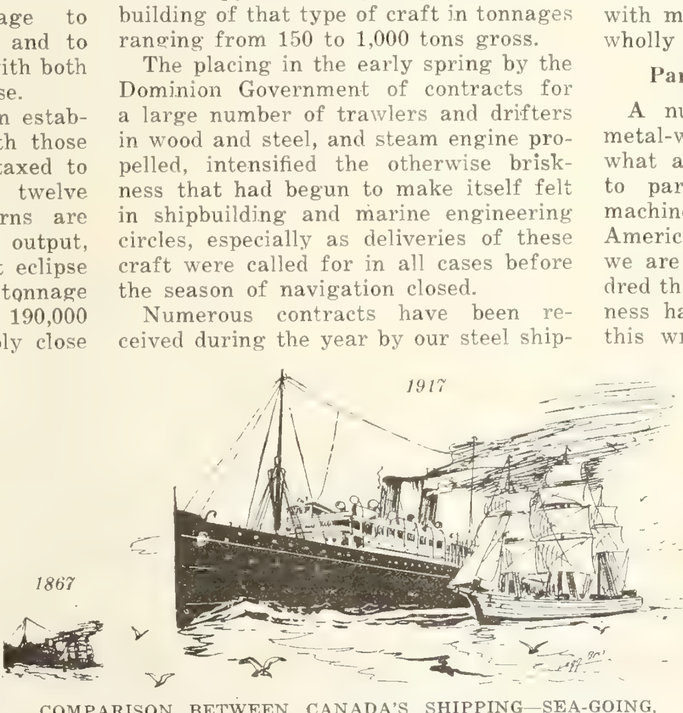
Wood Schooner Construction

In the early part of the year quite a number of auxiliary powered ocean-going schooners of wood construction were built and completed in British Columbia, and several of them have already made voyages to Australia and back. The advent of the Imperial Munitions Board, Ottawa, with contracts for large steam-engine propelled steel and wood ocean-going freighters had the effect of halting the construction of auxiliary powered wood schooners, hence the concentration of effort on the former in recent months.

Wood schooner construction continues to be actively prosecuted, however, in Nova Scotia, some twenty-five or thirty little shipyards being engaged in the building of that type of craft in tonnages ranging from 150 to 1,000 tons gross.

The placing in the early spring by the Dominion Government of contracts for a large number of trawlers and drifters in wood and steel, and steam engine propelled, intensified the otherwise briskness that had begun to make itself felt in shipbuilding and marine engineering circles, especially as deliveries of these craft were called for in all cases before the season of navigation closed.

Numerous contracts have been received during the year by our steel shipbuilding yards from interests unconnected with either the Imperial or Dominion Governments, data concerning which will be found in the individual plant references that follow.



COMPARISON BETWEEN CANADA'S SHIPPING—SEA-GOING, COASTAL, LAKE AND RIVER VESSELS AT CONFEDERATION AND NOW.

It is of course well known that the American Government through its Shipping Board and Emergency Fleet Corporation has a gigantic shipbuilding programme on hand, the vessel constituent of which embraces both wood and steel construction as in the case of the contracts placed by our Imperial Munitions Board. Propelling and auxiliary machinery, the latter including that required for ship deck and engine room, has been ordered in a majority of instances separate as to location of vessel hull construction as well as separate as to firm engaged on the latter.

The idea behind the scheme is of course to enable plants with contracts for hulls and their accessories to concentrate wholly on these, and the plants with machinery contracts to concentrate wholly on that particular feature.

Participation in U. S. Contracts

A number of enterprising Canadian metal-working plants took advantage of what appeared to them an opportunity to participate in the distribution of machinery orders for vessels on the American Government programme, and we are pleased to say that several hundred thousand dollars worth of such business has been secured as a result. At this writing, we are in a position to state that good progress is being made in the matter of this particular equipment output, and little doubt is entertained but that further substantial contracts are likely to be booked from the same source.

A gratifying feature of the shipbuilding and marine engineering industry in Canada during the year has been the absence of labor troubles, of such a nature at least as to tie up production for any great length of time. Departmental strikes have been of frequent occurrence nevertheless, the demand more often than not being for higher wages.

Labor scarcity—skilled and unskilled—has affected adversely the output of new construction at many centres, and now that conscription is operative, there is little chance of relief being afforded until the war is over.

Canadian shipyards have also been

much hampered in their operations as a direct result of the United States war activities. The plate and shape requirements of the latter for its shipbuilding programme added to its munitions steel needs called for an embargo being placed on commodities of that nature, and while provision is made whereby export under license may be effected, no end of inconvenience and delay has been experienced in procuring material.

At the moment no relief is in sight notwithstanding the fact that our Government and our manufacturers, individually and collectively, have sought a "way out."

Ship construction costs come high these war times both from a wage and material point of view, yet having regard to the need of "bottoms," it may be said without fear of contradiction that cost is secondary to either prompt receipt in quantity of the steel, or the labor to make use of that steel to the best advantage.

I. M. B. Steel Vessel Contracts

As already stated, the Imperial Munitions Board have placed contracts for wood as well as steel ocean freighters, both classes of vessel being steam engine propelled. The total number of steel ships ordered by the Board up to December 3rd is given as forty-four, of which four had been delivered. Their individual capacity ranges from 1,800 to 8,800 tons d.w., making a grand total carrying capacity of 213,600 d.w. tons.

The steel ships are being built at New Glasgow, N.S.; Montreal, Toronto, Welland, Midland, Collingwood, and Port Arthur, Ont.; Vancouver and North Vancouver, B.C. The majority of the vessels are of the 3,400, 3,500 d.w. capacity class, each shipyard being responsible to a great extent for the creation of the necessary specifications and drawing.

I. M. B. Wood Vessel Contracts

The total number of wood steamships ordered by the Imperial Munitions Board up to December 3rd is given as forty-six. Twenty-seven of these are being built in British Columbia and nineteen in Eastern Canada. The individual carrying capacity of the wood ships is 2,500 tons d.w., making a total carrying capacity of those on order of 115,000 d.w. tons.

BOW VIEW OF S.S. "PORSANGER" SHOWING ALSO LAUNCHING PLATFORM AT CANADIAN VICKERS SHIPYARD, MONTREAL.

The wood ships are being built at Liverpool, N.S.; St. John, N.B.; Isle of Orleans, Cote St. Paul, Quebec and Three Rivers, Que.; Toronto and Fort William, Ont.; Coquitlam, New Westminster, Vancouver, North Vancouver, and Victoria, B.C.

From the foregoing it will be noted that the Imperial Munitions Board have placed orders during the year for new construction—wood and steel, covering ninety vessels of an aggregate tonnage, carrying capacity, of 328,600 d.w. tons.

Norwegian Vessel Contracts

In addition to the vessels placed with Canadian shipyards to Imperial Munitions Board orders, twenty-two steel steamships of 3,500 tons d.w. capacity have been ordered by outside companies on Norwegian account, or a total in this connection of 77,000 d.w. tons. Adding this to the wood and steel tonnage placed by the I. M. B., there is shown under contract in the Dominion a total of 405,600 d.w. tons, the value of which somewhat exceeds $80,000,000.

Canadian Allis-Chalmers, Bridgeburg, Ont.

The Canadian Allis-Chalmers, Toronto, Montreal and Bridgeburg, Ont., have contracted with the Imperial Munitions Board, Ottawa, for the construction of four steel steamships of 3,500 tons each, and good progress has already been made on the plant layout and with the equipment installation, notwithstanding the fact that a definite decision to include shipbuilding and marine engineering among the other activities of the Company was only come to within the last two months or so.

Some ten years ago a lake freighter was built at the Bridgeburg plant, but since then the fabrication of structural steel has constituted the principal output. The leading dimensions of each of the four vessels are as follows:

TANK TOP OF STEEL VESSEL UNDER CONSTRUCTION IN SHIPYARD OF J. COUGHLAN & SONS, VANCOUVER, B.C.

STEEL VESSEL IN FRAMES AND PARTLY PLATED IN SHIPYARD OF J. COUGHLAN & SONS, VANCOUVER, B.C.

STEEL SHIPBUILDING YARD OF J. COUGHLAN & SONS, VANCOUVER, B.C.

SCENE ON LAUNCHING PLATFORM IMMEDIATELY BEFORE THE S.S. "PORSANGER" LEFT THE WAYS AT CANADIAN VICKERS SHIPYARD, MONTREAL.

S.S. "PORSANGER" TAKING THE WATER FROM CANADIAN VICKERS SHIPYARD, MONTREAL.

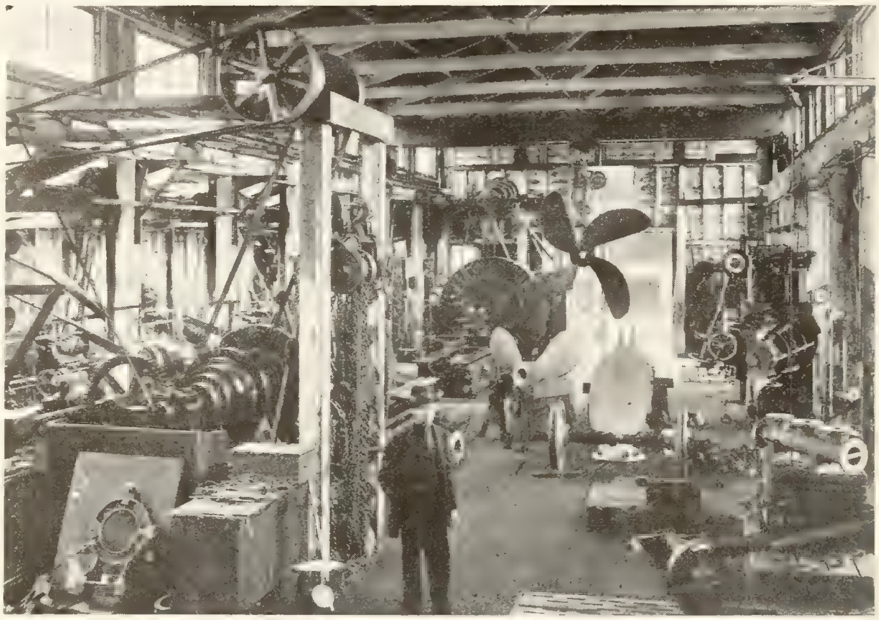
Length over all, 261 ft.; beam molded, 43½ ft.; depth molded, 23 ft. They will be of the usual bulk cargo type, of Class 100 A. I. Lloyd's Register, and will embody in their design, structural detail, and equipment, such features and appliances as will render them immune to the fullest possible extent from enemy submarine attacks.

The steel is being supplied by the British Government through the Cunard Steamship Co., and we understand that a considerable tonnage has already been delivered to the plant.

The propelling machinery is to be built at the Company's Davenport Works, Toronto, and will consist of single screw triple expansion engines of the surface condensing type, the cylinder diameters being 20 in., 33 in., and 54 in., by 40 in. stroke. There will be two boilers in each ship, of 14 ft. in diameter by 12 ft. long. Howden's system of forced draught will be installed and the working steam pressure will be 180 pounds per sq. inch.

Coal bunkers of 500 tons capacity will be located in the wings of the boiler space and under the bridge deck. The cargo holds will be three in number, that abaft the engine room having two hatches and those forward having one hatch only. Each cargo hatch will be served by two independent cargo derrick booms of 5 tons capacity, and each boom will have its independent cargo winch.

A steam steering engine will be located in a special house abaft of the engine casing on the upper deck. The life-saving equipment will consist of two 25 ft. lifeboats and one 18 ft. working boat. The water ballast tanks of three feet depth amidships will extend the entire length from the collision bulkhead forward to that of the peak tank aft. Living quarters will be steam heated and electric lighting will be installed throughout.

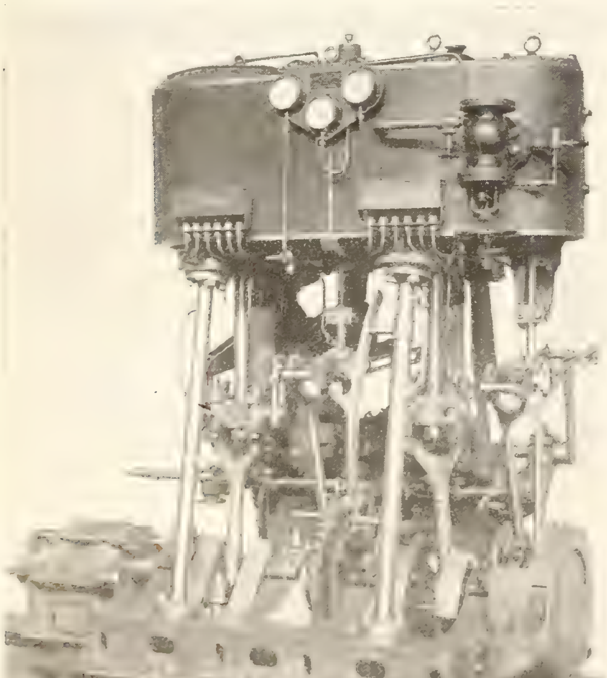


SECTION OF MACHINE SHOP, YARROWS, LTD., ESQUIMALT. B.C.

Yarrows, Ltd., Esquimalt, B.C.

During the present year, Yarrows, Ltd., Esquimalt, B.C., have carried out a considerable amount of naval repair work for the Imperial, Canadian, and Japanese Governments, and when this statement was prepared activities in the like direction had by no means ceased. Apart from the foregoing, the firm during the past twelve months has undertaken much work of a general marine character, among which may be mentioned that of a Grand Trunk Pacific Co. steamship that had been ashore. This vessel was repaired at Esquimalt, which involved the renewel of practically the ship's bottom for a length of 180 ft.

Among other repair work of an interesting and arduous nature to which the energies of the plant have been directed in recent months may be cited that of the Niels Nielson, an 8,800 ton cargo vessel, which has sustained heavy dam-



FRONT AND BACK VIEWS OF COMPOUND SURFACE CONDENSING MARINE ENGINE WITH CYLINDERS 18 IN. AND 38 IN. IN DIAMETER BY 24 IN. STROKE, BUILT BY GOLDIE & McCULLOCH, GALT, ONT.

age due to stranding; the fitting of an 18 ft. diameter manganese bronze propeller to a new fully laden vessel of 8,800 tons cargo capacity which had been brought back from sea in a disabled condition; the removal of some 37 plates, the relining and straightening, and removal of the stern frame of the steamship Gray which, in addition to being badly damaged generally, had her back broken and buckled.

Aside from the foregoing, a large number of vessels of various sizes and types have been drydocked for minor repairs and overhaul.

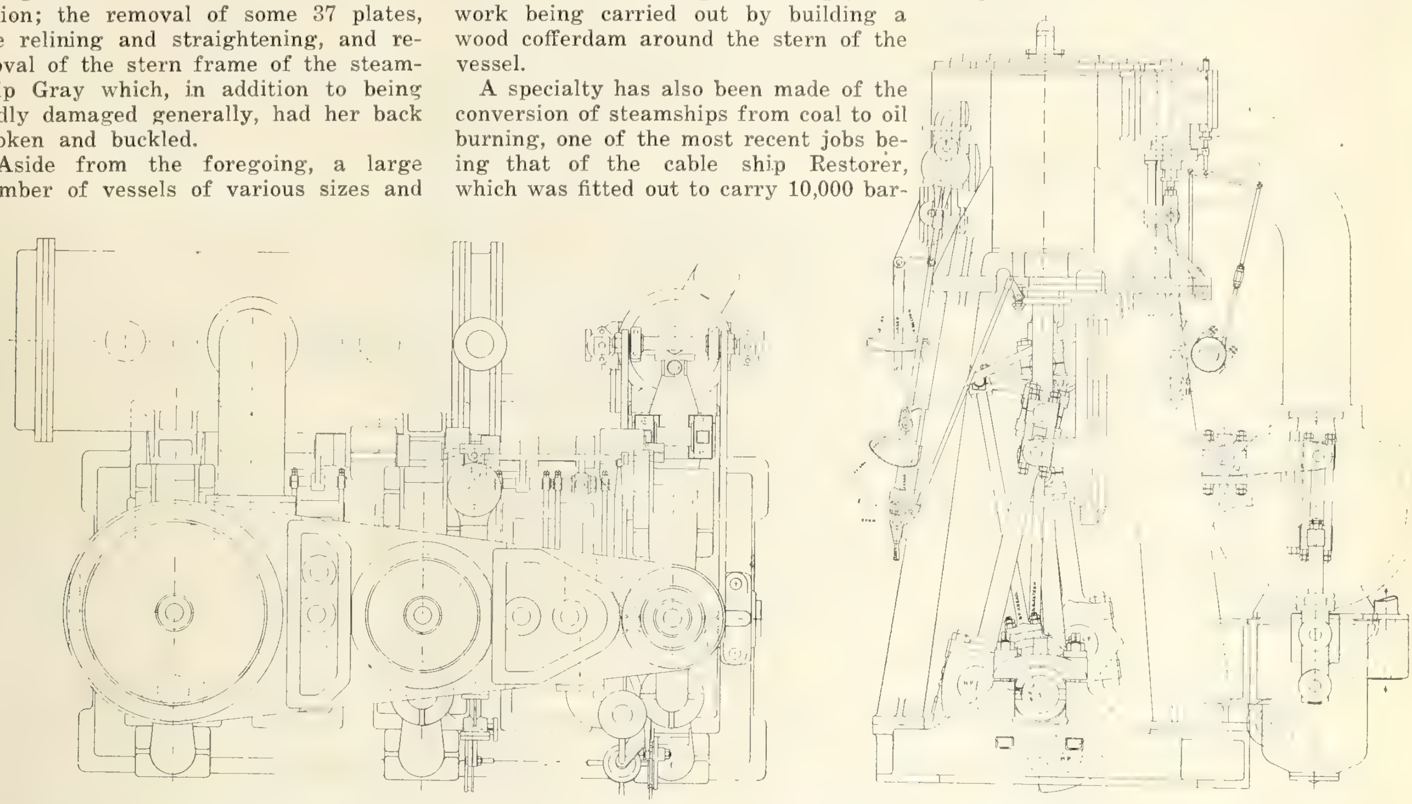
In the matter of new work during 1917, the firm have completed and shipped to India two sternwheelers of 132 ft. in length and 32 ft. beam, two more exactly similar and one of larger dimensions being at present under construction.

Yarrows Ltd. have made a specialty of the manufacture of cast iron and manganese bronze propeller blades, some of the latter weighing as much as 12 tons. In this connection it may be mentioned that the 18 ft. diameter manganese bronze propeller already referred to was cast, fitted, and the ship made ready for sea within a week without docking or disturbing her cargo, the work being carried out by building a wood cofferdam around the stern of the vessel.

A specialty has also been made of the conversion of steamships from coal to oil burning, one of the most recent jobs being that of the cable ship Restorer, which was fitted out to carry 10,000 barrels of fuel oil. Several of the C.P.R. steamers, the coast fleet of the G.T.P. and various local dredges have all been converted from coal to oil burning.

During the year the firm has made many large marine engine and other castings, consisting of bedplates, cylinders for triple expansion engines of 24 in., 38 in., and 62 in. diameter by 42 in. stroke; also some large nitric acid retorts running up to a weight of 8 tons each.

An oxy-acetylene cutting and welding outfit, a galvanizing plant, and the provision of the necessary equipment to handle expeditiously and efficiently special coppersmithing and pipe work, round out a shipyard installation admirably adapted to meet the needs of the local shipping and those of much farther afield.



TRIPLE EXPANSION MARINE ENGINES WITH CYLINDERS OF 12¾ IN., 21½ IN. AND 35 IN. IN DIAMETER BY 24 IN. STROKE, BUILT BY GOLDIE & McCULLOCH, GALT, ONT.

The yard is situated at Esquimalt Harbor adjoining the site of the proposed new Government drydock, and covers an area of about 8 acres. The wharf is over 500 feet long and can accommodate on both sides vessels sent in for overhaul and repairs. The marine railway can take care of vessels up to 300 feet in length and of 2,500 tons deadweight. Vessels of larger size up to 480 feet are handled in the drydock. A 60 ton shearlegs and a 10 ton floating

MARINE RAILWAY AND REPAIR SLIPS, YARROWS, LTD., ESQUIMALT, B.C.

derrick are conveniently located for dealing with heavy lifts. There is also a floating compressed air plant for use on vessels lying off the yard. An average of 250 men are employed the year round.

Yarrows, Ltd., of Esquimalt, B.C., has direct association with Yarrows & Co., Ltd., of Glasgow, Scotland.

Goldie & McCulloch Co., Galt, Ont.

The Goldie & McCulloch Co., Galt, Ont., up till early in the present year had not undertaken the building of marine engines; the statement which follows is, therefore, the more interesting, as showing what can be done by an engineering firm well equipped and organized in other than its regular lines of manufacture.

The company was asked early in the year if they could undertake the building of a number of compound marine engines, with pumps, surface condensers, etc., complete from stop valves to propellers, of a size to develop 200 indicated horse-power with steam at 140 lbs. per sq. in. working pressure, and piston speed of 500 ft. per minute. The accompanying line cut and half tones serve to illustrate the completed engine features. The cylinder diameters are 18 in. and 38 in. in diameter by 24 in. stroke. A total of one hundred of these engines was required of which the Goldie & McCulloch Co. were awarded forty, the remainder being placed in lots of thirty downward among plants in Canada and the United States.

BOW VIEW OF STEEL FREIGHTER "WAR DOG" WHILE ON THE WAYS.

As all the firm's machine tools were not available at the time, a large number being employed on munitions work, an arrangement was made with the Canada Machinery Corporation, Galt, Ont., to undertake some of the machine work, the various parts being divided into unit groups capable of being finished and assembled complete in themselves.

As the drawings, all of which were supplied to the different contractors, arrived, they were at once sent into the shops and at the same time jigs were put in hand for machining and drilling the various parts. These jigs were ready ahead of the castings and forgings for which they were intended, so there was no delay on that score.

The first drawing was received about April 10. Pattern work was at once started, a number of special moulding boxes, some in duplicate for certain parts, being got ready at same time. Casting proceeded at a rapid rate and it was a common occurrence for a cylinder, bed-plate, condenser shell, propeller, two stern tubes and a quantity of smaller castings to be made per day for several consecutive days. Several sets of the larger castings were at the same time made for another concern. The firm were considerably handicapped by slowness in delivery of heavy forgings, condenser tubes, etc., which they had to purchase, and also by the fact that sufficient skilled labor to run a night shift was not procurable. Good progress was made notwithstanding.

The stern tubes, tail shafts, and propellers being required first to let the shipbuilders finish the hulls, the first effort was concentrated on these and shipment averaged five complete sets per week for several weeks. The first engine and condenser were shipped on

OCEAN FREIGHTER "WAR DOG," 300 FT. B. P., 45 FT. BEAM, AND 27 FT. MOLDED DEPTH, BEING LAUNCHED FROM WALLACE SHIPYARDS, NORTH VANCOUVER, B.C.

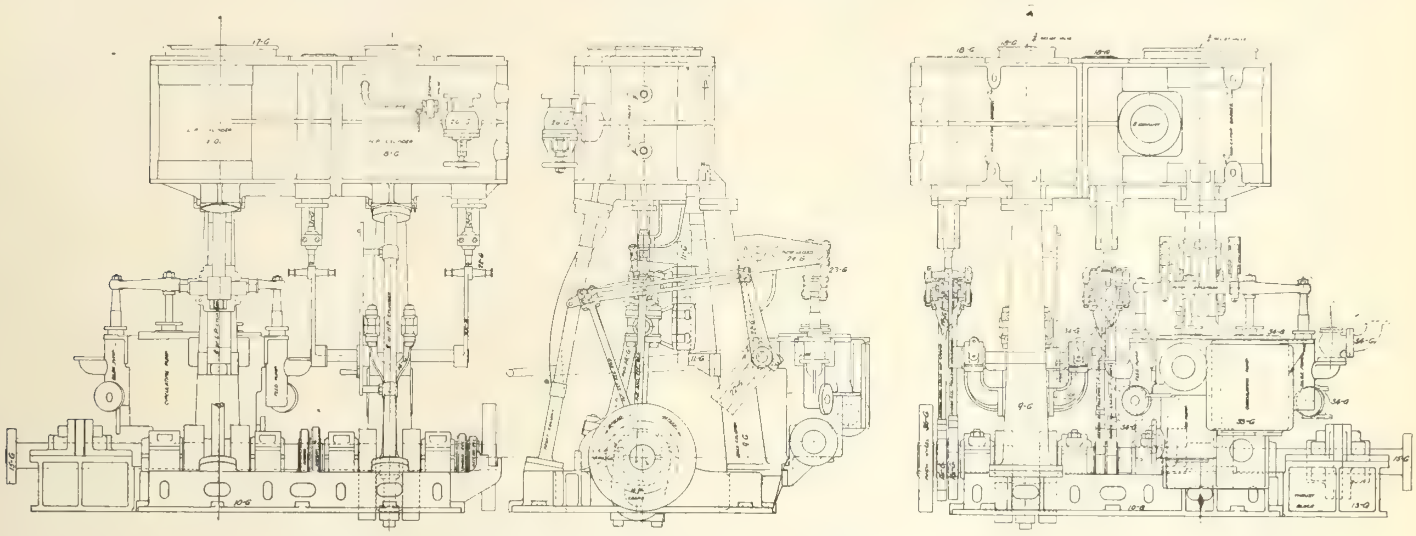
August 24, and the last on November 27 —about 13 weeks. It will be seen from the above that shipments over this period averaged over three engines per week.

At the start shipments were naturally slower but as the work came forward and the men got used to it they speeded up with the result that, for six weeks, shipments averaged four per week, and for two weeks five engines were completed and tested each six days. We understand, that when about thirty-five engines had been shipped, the total received from the eight or nine other builders combined, had been equalled.

While these engines were being constructed, the Goldie & McCulloch Co. were also busy on other work in their engine department. Thirty-three ship-lighting engines of their well known forced lubrication type were completed, and considerable work was done on another order of fifty of same type. They are building at present some one hundred and twenty of these engines for lighting sets, connecting to fans, and pumps for shipboard work, for various shipbuilders, government and naval requirement, including the United States Emergency Shipping Board.

The vertical enclosed forced lubrication engine is used to the exclusion of almost all others by British shipbuilders for small auxiliary engines and the Goldie & McCulloch Co. have developed it in accordance with the best British practice. One of their compound admiralty type installations was connected to an armoured generator made by the Electric Ordnance & Accessories Co., Birmingham (Vickers Ltd.), and fitted on a Russian naval vessel.

The company are now building a number of triple expansion marine engines of 500 horse-power, the accompanying line drawing showing the general design. Further large contracts are pending. They have also specialized in ships' sidelights, marine type vertical boiler feed pumps, bilge and ballast pumps, also some special lines of brass work, etc. The name—Goldie & McCulloch has always stood for high class products and progress, and as might be expected they are in the forefront of the new Canadian industry of marine engineering.



COMPOUND MARINE ENGINES WITH CYLINDERS 12 IN. AND 26 IN. IN DIAMETER BY 16 IN. STROKE, BUILT BY THE JOHN McDOUGALL CALEDONIAN IRON WORKS, MONTREAL.

J. Coughlan & Sons, Vancouver, B.C.

J. Coughlan & Sons is a private enterprise, being controlled by J. Coughlan, a British Columbia pioneer, and his two sons J. J. Coughlan and S. H. Coughlan Prior to the war the firm was engaged in the sale and fabrication of structural steel for railway and highway bridges and steel frame buildings as well as in the manufacture of building bricks. They were highly successful in these spheres of commercial endeavor, having constructed almost all of the steel frames now standing in British Columbia in addition to a number of railway bridges.

The outbreak of war put a stop to the demand for specialties of the nature indicated, consequently new fields of enterprise had to be sought. Contracts were secured for six steel vessels of 8,800 tons deadweight capacity each, delivery of all to be guaranteed by the end of the year 1918.

It was found necessary to completely overhaul and re-equip the structural steel fabricating plant and in this regard no expense was spared, the result being that to-day the shipbuilding capacity of the yard will compare very favorably with any similar establishment north of San Francisco. Four keels have been laid down and construction work is proceeding simultaneously on

OCEAN-GOING WOOD SCHOONER CONSTRUCTION IN BRITISH COLUMBIA.

three of the vessels, the first of which will be launched shortly.

Each ship is to be steam turbine driven, contracts for the turbines having been placed in the United States. The boilers of Scotch type will, however, be built in the J. Coughlan & Sons' yard at Vancouver.

The firm is meantime giving employment to over 1,000 men and expectations are that before long as many more men will be on the pay-roll. The illustrations give a fairly comprehensive idea both of the extent of the plant and the magnitude of the work being carried out.

Early in December a contract for four more 8,800 ton freighters similar in all respects to the six already on hand was received from the Imperial Munitions Board.

Nova Scotia Steel & Coal Co., Trenton, N.S.

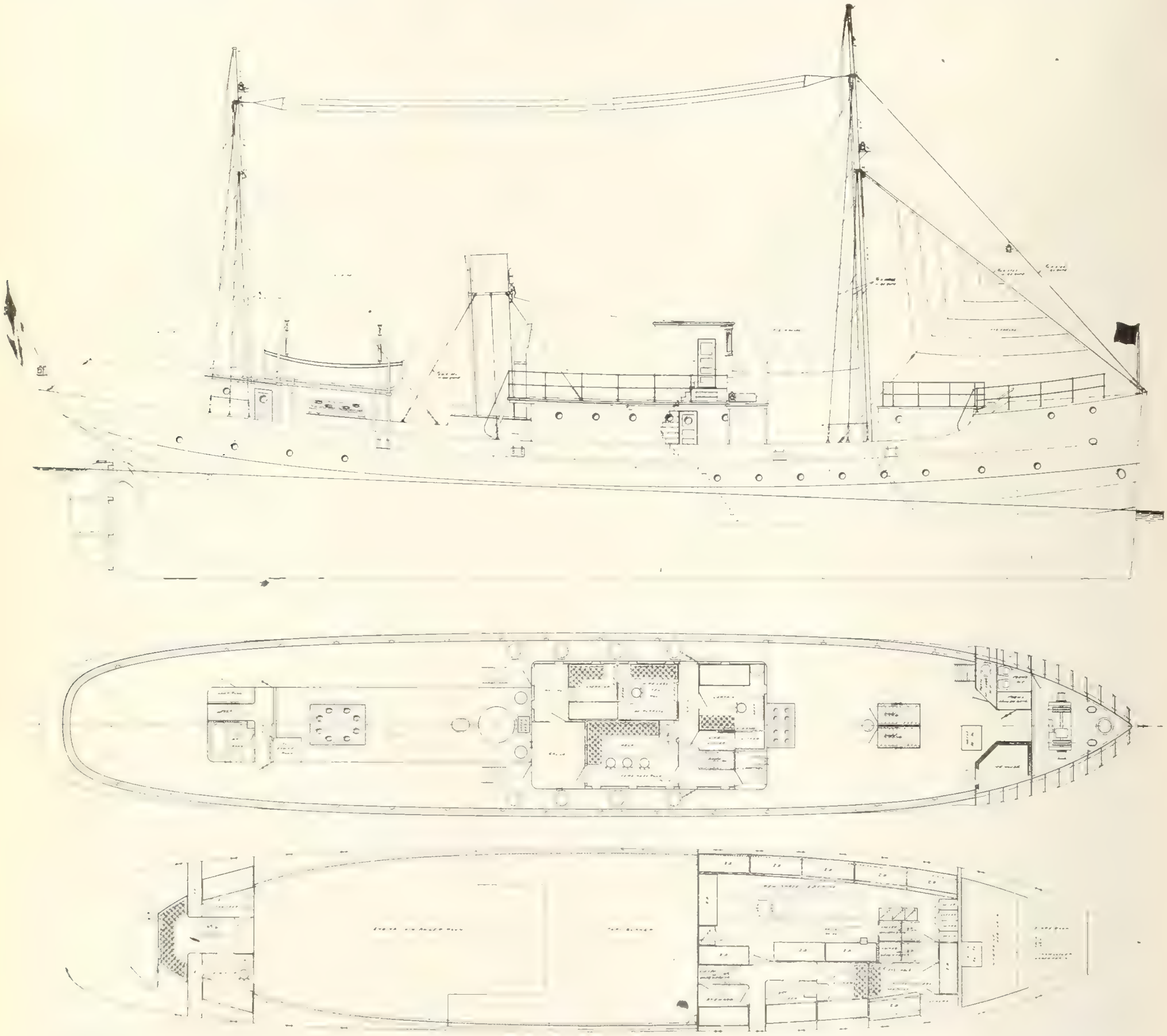
Although meantime engaged in the dual crafts of shipbuilding and marine engineering along with its other metal-working activities, no definite decision has been arrived at concerning the permanent establishment of either or both enterprises as part of the Nova Scotia Steel & Coal Co. future industrial programme. Two steel ocean-going steamships are at present under construction, and about the middle of the year a similar vessel was completed and sent to sea. The latter was steam turbine driven, while those now under construction will have regular type triple expansion surface condensing marine engines of "Scotia" manufacture.

It was hoped to have launched one of the vessels this fall, but shortage of labor made this impossible. As a result the launching will not now take place until the spring of next year. About 240 men are employed on the two ships now building, and something like 25 men are engaged on the engines at the New Glasgow plant of the company.

Port Arthur Shipbuilding Co., Port Arthur, Ont.

Early in the present year the Western Dry Dock & Shipbuilding Co., Port Arthur, Ont., gave place to the Port Arthur Shipbuilding Co. The capacity of the plant then was that of two 4,200-ton steel freighters building at one time, or an annual output of six vessels. Additional berths have since been constructed, which will about double the capacity, and there is little doubt but what full advantage will be taken of the enlarged accommodation to help relieve the shipping shortage.

The present year has been the biggest in the history of the yard as regards new construction, several ocean-going freighters and a number of deep sea trawlers having been completed and passed into service. The last official statement available showed a total of 16,267 tons of new construction on hand, of which seven cargo vessels represented 14,737 gross tons.



ACCOMMODATION AND RIGGING PLANS OF A FLEET OF FISHERIES PROTECTION VESSELS BUILT IN CANADA DURING 1917.

Collingwood Shipbuilding Co., Collingwood, Ont.

On January 2 this year transfer of the property of the Collingwood Shipbuilding Co. was made to H. B. Smith, J. W. Norcross, and R. M. Wolvin, the capitalization named in connection with the transfer being $2,000,000. During the present year nine steel vessels of a total of 15,000 gross tons have been built, launched engined and completed, the individual units consisting of one cargo steamer of 550 feet in length and 7,988 gross tons; two oil tankers, each 250 feet in length and of 2,642 gross tons; six deep sea trawlers, 125 feet in length and of 288 gross tons each. Several sets of engines and boilers were also constructed for vessels building elsewhere.

Needless to say the order books of the shipyard carry capacity on new construction well into the New Year which, taken in conjunction with anticipation of at least the average amount of repair work and overhauling, leads to the expectation that the ensuing twelve months will be the banner year in the company's history. It is of interest to note that from 1900, the year in which the shipyard was organized, until the present, 58 new vessels have been built.

THE COLLINGWOOD SHIPBUILDING CO. VESSELS LAUNCHED DURING 1917.

Type	Name	Yard No.	Dimensions Length	Breadth	Depth	Gross Tons	D.W. Tons	Engines	Boilers.	Speed Knots	H.P.	Owners	Launching Date
Cargo	Westmount	48	550	58	31	7,988	11,000	24-40-66 / 42	3@13′ 0″ x 11′ 0″	12	2,400	Montreal Trans. Co.	May
Oil tanker	Reginolite	49	250	44	25	2,642	3,700	18-30-50 / 36	2@13′ 6″ x 11′ 0″	10.5	1,200	Imperial Oil Co.	June
" "	Tararolite	50	250	44	25	2,642	3,700	18-30-50 / 36	2@13′ 6″ x 11′ 0″	10.5	1,200	International Oil Co.	Oct.
Deep sea trawler	T. R. 7	53	125	23½	13½	288	185	12¾-21½-35 / 24	1@13′ 6″ x 10′ 6″	10	500	Dept. Naval Service	Sept.
"	T. R. 8	54	"	"	"	"	"	"	"	"	"	"	"
"	T. R. 9	55	"	"	"	"	"	"	"	"	"	"	Oct.
"	T. R. 10	56	"	"	"	"	"	"	"	"	"	"	Nov.
"	T. R. 11	57	"	"	"	"	"	"	"	"	"	"	Dec.
"	T. R. 12	58	"	"	"	"	"	"	"	"	"	"	Dec.
		9				15,000					7,800		

Lyall Shipbuilding Co., North Vancouver, B.C.

The Lyall Shipbuilding Co., North Vancouver, B.C., have a contract to build six wood freighters for the Imperial Munitions Board, and not only have keels for all six been laid down, but one of the six took the water during the present month. As regards shipyard equipment, travelling derricks have been installed, and in the matters of a mill and small tools, these have been provided with a view to securing rapid and efficient output in every case.

M. Beatty & Sons, Welland, Ont.

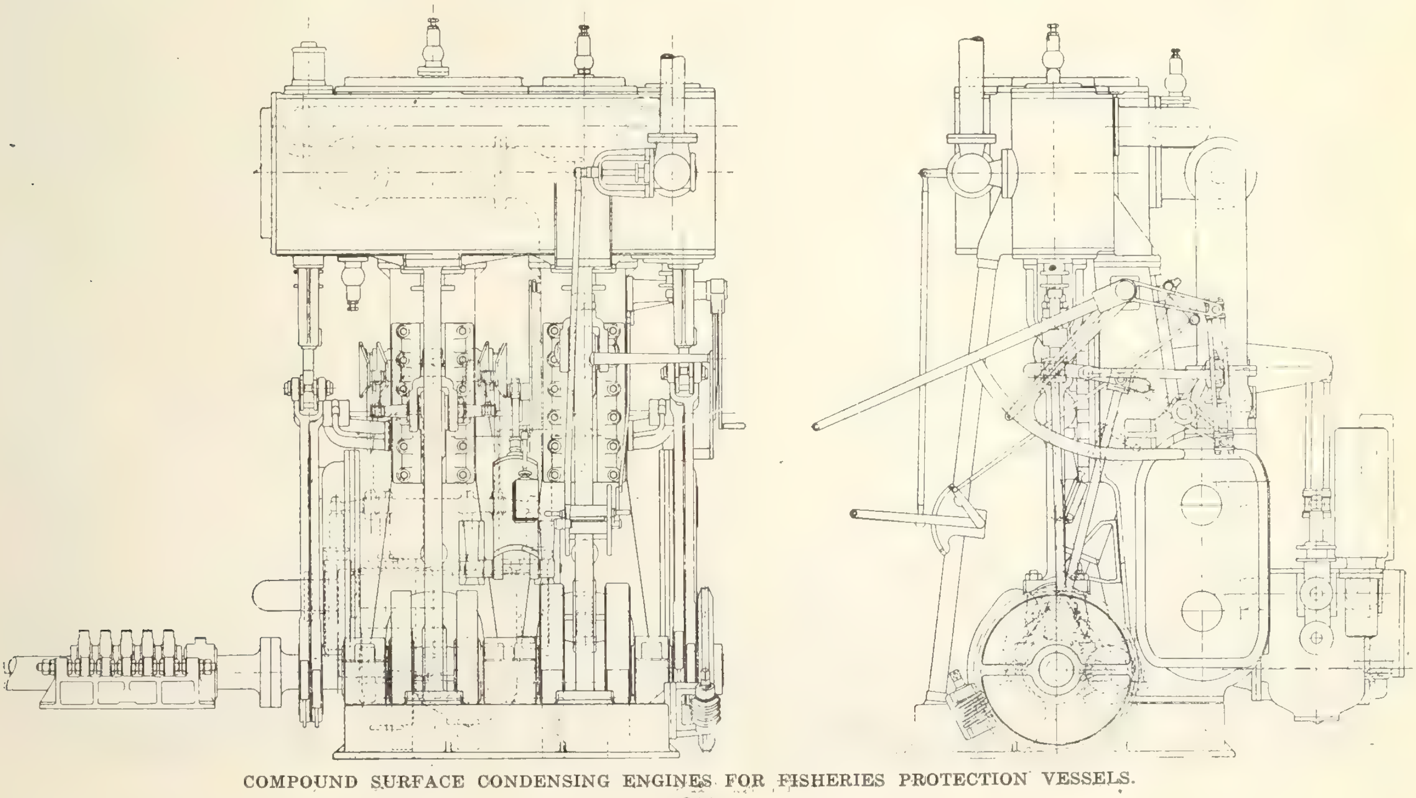
This old-established concern on the Welland Canal have leased their shipyard and plate shop to the Welland Shipbuilding Co., who are building two standard steel steamships, and are understood to have other orders on hand.

M. Beatty & Sons' principal product at the moment consists of cargo winches, anchor windlasses, and ash hoists. In addition to building these to the order of the Imperial Munitions Board, they are also supplying them to the order of private shipbuilding interests throughout the Dominion.

They have not yet gone into the building of propelling engines or boilers, their equipment for turning out the larger horse powers at least being scarcely heavy enough. The building of marine engines for vessels of 1,000 tons and under is, however, under consideration.

Canadian Government Shipyard, Sorel, Que.

The Canadian Government shipyard at Sorel is under the direction of the Department of Marine and Fisheries, Ottawa, and aside from new construction, much repair work on the various units of the



COMPOUND SURFACE CONDENSING ENGINES FOR FISHERIES PROTECTION VESSELS.

MOTOR SHIP "CHIRALITE" AS SHE APPEARED ON HER TRIAL TRIP AT VANCOUVER.

St. Lawrence River ship channel fleet and on the Department of Public Works vessels in the district is undertaken the year round. Construction of buoys for the Department is another direction in which the activities of the plant tend, buoys of various designs being shipped to waterways in all parts of the Dominion. During each winter the St. Lawrence ship channel fleet, embracing 15 dredges and attendant vessels—about 100 in all, are wintered at the sorel plant, where repairs are made and the different vessels are overhauled and outfitted for the following season of navigation.

The new work completed during the present year includes the following: Steel staff tug "Berthier" for the St. Lawrence Ship Channel. Length, b.p., 120 ft.; breadth molded, 24 ft.; depth molded, 12 ft. 6 in.; gross tonnage, 368; indicated horsepower, 550; speed 13 miles per hour. The propelling machinery which is of the twin screw compound surface condensing type was, along with the boiler, built at the shipyard.

Steel steamer "Argenteuil," built for buoy service on the Ottawa River: Length over all, 100 ft.; breadth molded, 21 ft.; depth molded, 9 ft.; gross tonnage, 175; indicated horsepower, 190; speed, 10 miles per hour. The machinery is of the single screw compound jet condensing type and was purchased outside. The boiler was, however, built at the shipyard. A winch and derrick for handling buoys up to 6 tons is installed.

Three wood and three steel vessels were built for the Imperial Government. Boilers for the former, and boilers and engines for the latter, were also constructed at the shipyard. All of these have been delivered except one steel vessel which is in the water, but cannot be completed until the opening of the 1918 season of navigation. During the present year an average of 800 men have been on the payroll, their efforts being directed to both new and repair work.

Thor Iron Works, Toronto

At the Thor Iron Works, Toronto, new vessel construction has embraced two ocean-going steel stamships and two steel deep-sea trawlers. One of the former and the two latter were launched and completed during the year. The second freighter will be launched early in January. The trawlers are similar in every respect to those built at Collingwood and by tre Polson Iron Works, in which circumstances it will be unnecessary to feature them here. The freighters were ordered in the first instance by the Great Lakes Transportation Co., but changed hands later. Their leading dimensions and propelling machinery details are as follows: Length over all, 261 ft.; beam, 43 ft. 6 in.; depth, 28 ft. 2 in.; d.w., 4.300 tons; engine cylinders, 20-33-54 in. in diameter by 40 in. stroke; two boilers each 14 ft. 6 in. in diameter by 11 ft. long; indicated horsepower, 1,300.

Contracts on hand consist of two freighters similar in every respect to the above except htat they will be of American registry. By the end of January it is expected that the keels of both will have been laid. The machinery for all of the vessels is being taken care of by the John Inglis Co., Toronto.

Taylor Engineering Co., Vancouver, B.C.

The Taylor Engineering Co., Vancouver, although really naval architects and consulting engineers have during the past two years constructed a number of small wood craft all under 100 ft. in length, the most notable being the motor ship "Chiralite," a photograph of the vessel appearing in this section.

The "Chiralite" is 85 ft. over all and has a beam of 18 ft. Being intended to enter fairly shallow water ports, her draft loaded has been kept down to 6 feet. She was contracted for by the International Petroleum Co. for service off the South American Coast. Her motor equipment consists of two sets of 70 horsepower Sterling engines. On her trial trips she developed a sped of 9½ knots. The fuel capacity amounts to 2,400 gallons, being sufficient to keep the machinery running continuously at full speed for two weeks. The vessel is lighted throughout from a Delco electric plant installation. Electric fans are installed in every cabin and state room, also in the engine room.

Muir Bros. Dry Dock Co.

Muir Bros. Dry Dock Co., whose plant is located at Port Dalhousie, the Lake Ontario end of the Old Welland Canal, report a busy season, repair work having been abundant to the extent that their two dry docks have been employed more than ever, especially by the larger class of vessels using the Welland Canal highway of Great Lakes shipping. These dry docks have probably a longer record of continuous business than any others on the lakes, having been owned and oper-

OCEAN FREIGHTER "ANGOULEME," BUILT AT THE THOR IRON WORKS, TORONTO, 1917.

ated by one family since 1850. The company has so far not revived its shipbuilding, but has confined its entire efforts of late years to repair work, mostly in wood, although steel vessels have often been docked for minor repairs.

The two dry docks which have been rebuilt within the last two years, are at 255 ft. and 185 ft. keel lengths respectively, the former of which is sufficient to accommodate the longest ships able to pass through the canal. The shipyard adjoining the docks is modernly equipped, the unit installation consisting of a mill for sawing timbers, frames, etc.; compressed air plant, forge, machine shop, etc. The various buildings are nearly all of brick and stone construction with metal roofs, and the yard has suace for shipbuilding should Muir Bros. or some other firm acting with them decide to take up same.

Polson Iron Works, Toronto

Polson Iron Works, Toronto, in common with other Canadian shipbuilding establishments, has experienced an abnormally busy year. The launches for the period include one 3,500 gross ton ocean-going freighter and ten deep sea trawlers. Four freighters similar to the above are under construction, and one of them will be launched in January of next year. During the past twelve months the shipyard has been generally enlarged and extended, so much so that notwithstanding the good tonnage output, as shown on the accompanying table, a very much better one is expected in the ensuing year. It should also be stated that in addition to the shipbuilding feature the propelling machinery, including boilers, is also constructed at the plant.

POLSON IRON WORKS, TORONTO—VESSEL OUTPUT DURING 1917.

Name.	Yard No.	Length Ft.	Breadth Ft.	Depth Ft.	Gross Tons	D.W. Tons	Engine Cylinders	Boilers.	Speed Knots	H.P.	Owners.	Launching Date	Type
Toronto	134	261	43½	23	2,350	3,500	20½ 33 54 / 36	Two 14 ft. by 12 ft.	10½	1,250	Christopher Hannevig	October	Cargo steamer
Ypres	135	135	23½	13½	325	....	18x38 / 24	Howden two-element W. tube	10	500	Dominion Government	June	Deep sea
Vimy	136	"	"	"	"	....	"	"	"	"	"	"	
Messines	137	"	"	"	"	....	"	"	"	"	"	"	Trawlers
St. Julien	138	"	"	"	"	....	"	"	"	"	"	"	
St. Eloi	139	"	"	"	"	....	"	"	"	"	"	July	
Festubert	140	"	"	"	"	....	"	"	"	"	"	"	
T.R. 15	141	125	23½	13½	288	....	12¾-21½-35 / 24	One 13 ft. 6 in. by 10 ft. 6 in.	10	500	Dept. Naval Service	Nov.	
T.R. 16	142	"	"	"	"	....	"	"	"	"	"	"	
T.R. 17	143	"	"	"	"	....	"	"	"	"	"	"	
T.R. 18	144	"	"	"	"	....	"	"	"	"	" "	"	

British Yukon Navigation Co., Vancouver, B.C.

Although the British Yukon Navigation Co. are not in the shipbuilding business but operate a fleet of boats on the Yukon River and the Atlin Lake, nevertheless during the present year they built two vessels for the latter service. One was of the composite freight and passenger type carrying about 100 tons of cargo on her freight deck and 85 first-class passengers on her saloon and texas decks. She was a stern-wheeler, 165 ft. long, by 35 ft. beam, and was propelled by engines of 16 in. cylinder diameter by 72 in. stroke.

The other vessel was for day service only, therefore had no sleeping accommodation. She was 85 ft. long and of 20 ft. beam, and was driven by twin screws operated through 280 horsepower Buffalo gasoline engines. The average speed of both vessels is 13½ miles per hour. No new construction is contemplated for the coming year.

John McDougall Caledonian Iron Works, Montreal

In common with other important and old established general engineering concerns in Canada, the John McDougall Caledonian Iron Works, Montreal, have taken up the manufacture of marine propelling engines, boilers, and engine room auxiliary equipment. A detail of the work completed and in progress follows:

Six sets of compound engines with cylinders 12 and 24 inches in diameter by 16 inches stroke, of 210 indicated horsepower each.

Six marine Scotch type boilers each 9 ft. 6 in. in diameter by 9 ft. long.

Six sets of ships' side valves.

Six sets of surface condensers of 400 sq. ft. C.S. each.

The foregoing have all been completed, delivered, and installed.

The work on hand and in progress consists of:—

Two sets of triple expansion engines with cylinders 12¾, 21½ and 35 inches in diameter by 24 inches stroke, of 560 indicated horsepower each.

Two sets of ships' side valves.

Two surface condensers of 600 sq. ft. C.S. each.

Two sets of triple expansion engines with cylinders, 20, 33 and 54 inches in diameter by 40 inches stroke, of 1,250 indicated horsepower each.

Two condenser circulating pumps independently driven by vertical marine type engines.

Two sets of 1,750 I.H.P. triple expansion engine castings, the cylinders of which are 21, 35 and 67 inches in diameter by 54 inches stroke.

Canadian Vickers Ltd., Montreal

The shipbuilding plant of Canadian Vickers, Montreal, easily takes precedence of all others in Canada both as regards the amount and nature of the operating equipment, extent of layout, etc., and the scope, weight and variety of vessel product capable of being turned out. Unfortunately little data is available concerning the activities of the present year; it may be affirmed, however, that merchant and naval vessel construction (new and repair), have not been lacking. We are safe in saying that more men are employed by Canadian Vickers than by all the other shipbuilding yards of the Dominion combined, a condition likely to prevail permanently, irrespective of what future development may take place in the industry within our borders.

On November 29 the ocean freighter "Porsanger" was launched, and the opening of the 1918 season of navigation will see her sister ship take the water. Both vessels are on order to Norwegian account and are of the following leading dimensions, etc.: Length over all, 394 ft. 6 in.; breadth molded, 49 ft. 3 in.; depth molded, 30 ft.; deadweight capacity, 7,000 tons; gross tonnage, 4,670; load draught, 24 ft. The propelling machinery consists of triple expansion engines, two main and one donkey boilers. The hull subdivision embraces 14 separate water-tight compartments, while a double bottom extends fore and aft throughout each ship's length. The water ballast capacity is 1,630 tons. Cargo handling, navigating and lighting equipment installed are of the most modern and efficient type.

The plant is meantime taxed to capacity in the matter of keels laid, notwithstanding the big extensions and additions to buildings and equipment that have been made during the year.

Fraser, Brace & Co., Montreal

Among recently established wood shipbuilding plants, attention may be directed to that of Fraser, Brace & Co., of Montreal. Although a new departure for this firm, they go into it with a wide expert knowledge of large construction work and engineering undertakings generally. They have acquired a very desirable location for the plant site, which consists of approximately eight acres adjoining the Lachine Canal, on the south side of the latter and in the district known as Cote St. Paul. The shipyard offers ideal conditions for its specific purpose, forming an old basin that is readily and rapidly being transformed into an excellent slip or dry dock. When this basin was formerly used, the entrance was bridged by the bascule bridge on the C.P.R. which runs paralle

to the canal; the abutments for the bridge being of concrete. The dam that at present prevents the water of the canal from entering the basin will eventually be replaced with a lock gate, so that the basin will form a dry dock 600 feet long and 150 feet wide; sufficiently large to provide erection and working space for four wood ships, each of which will be 250 feet long and of 42 feet beam.

The initial contract secured is for four standard 2,500 ton boats, and construction is now well advanced for two of these the keels being placed on the pile foundations which have been laid on the eastern bank of the slip. The first two will be side-launched when completed. The keels for the other two will be laid in the bed of the slip, and when the boats are finished they will be floated by simply flooding the slip, water being allowed to pass through the canal entrance. This method will eliminate the construction of launching ways and will also facilitate the actual "launching" operation.

A tentative contract has been obtained for other four boats of the same class, and provision is being made to accommodate the entire eight at the one site; four in the slip and the remainder on the upper level. Buildings have been erected for offices, stores, air compressors, transformers, saw mill, also carpenter and machine shops. A mold loft 150 feet by 50 feet has also been provided. The power used throughout will be electric. The property adjoins both the G.T.R. and the C.P.R., admitting of facilities for the handling of materials promptly and direct to the job.

It is anticipated that within a few months Fraser, Brace & Co. will have a force of about 600 men employed as the first four boats are to be delivered by the middle of 1918. Their contract covers the building of the hulls only, the installation of propelling machinery, general equipment and the interior fittings being taken care of by other contractors.

The Foundation Co., Victoria, B.C.

The Foundation Co. with shipyard at Victoria, B.C., have contracts on hand for five 2,500-ton wood ships and in view of the fact that virgin ground was broken for construction purposes, it may occasion some surprise when we state latest advices give indication of some real live progress.

Wallace Shipyards, North Vancouver, B.C.

The Wallace Shipyards at North Vancouver, started the present activity on that part of the Pacific Coast. The original programme called for the construction of six auxiliary powered schooners for the Canada West Coast Navigation Co., all of which, according to our information are now completed. Later the order to build a similar vessel was received from the Federal Government, its particular service to be for the most part between the Atlantic and the Pacific. Arrangements were next made for the building of three steel setamships. One of these has been completed and is now in commission. Work on the second is well advanced and she will be launched early in the New Year. The outlook for the coming twelve months is unusually bright, the firm's order books showing contracts on hand to cover 4 cargo steamers of 17,500 combined gross tonnage.

Western Canada Shipyards Vancouver, B.C.

The Western Canada Shipyards with plant located on False Creek are building six wood steamships for the Imperial Munitions Board, and good progress has already been made on two of them.

Cameron-Genoa Mills Shipbuilders, Vancouver, B.C.

This firm have all but completed the contract they had on hand early in the year for six auxiliary powered schooners for the Canada West Coast Navigation Co., as a result they are now devoting almost their whole attention to the building of 4 wood steamships for the Imperial Munitions Board.

Grant & Horne, St. John, N.B.

The young general contracting firm of Grant & Horne, have gone into the business of wood shipbuilding at Courtenay Bay, St. John, N.B., a contract having been received from the Imperial Munitions Board for two wood steamships of 2,800 gross tons each. Latest reports indicate good progress, present anticipations being that the first vessel will take the water in the early spring of next year.

D. A. Saker & Co., West St. John, N.B.

The wood shipbuilding plant of D. A. Saker & Co. is located on what is known as the Straits Shore, West St. John, N.B. The necessary buildings have been erected and the equipment installed. One wood auxiliary powered schooner is at present under construction, her length being about 180 feet. She is not under contract, it being the intention of the builders to sell her while on the way or after completion.

Pacific Construction Co., Coquitlam, B.C.

The Pacific Construction Co. has taken over the plant of the Coquitlam Shipbuilding Co. at Coquitlam, B.C. and are there engaged in turning out two wood steam freighters of 2,800 gross tons each.

Montreal Dry Dock Co., Montreal, P.Q.

The Montreal Dry Dock Co. has experienced a year of unusual activity, the greatest trouble having been to furnish the necessary docking facilities to meet the demand. Shortage of skilled labor operated towards a prolongation of the time spent by vessels when in dock, thus aggravating the situation still further.

Hall Engineering Works, Montreal, P.Q.

Marine repairs both ship and engine continue to be a feature of the activities of the Hall Engineering Works, Montreal, so much so that notwithstanding the lesser number of ships using the harbor of the Canadian Metropolis than was the case in normal or peace-time years, due in large measure to fewer of them being available, the past twelve months appears to have been about the busiest of any similar period since the enterprise was established.

Kingston Shipbuilding Co., Kingston, Ont.

The Kingston Shipbuilding Co. in addition to at least its normal amount of repair, overhaul, and dry dock activities, built and completed two deep sea trawlers similar to those referred to elsewhere. The dry dock at Kingston is owned by the Federal Government and is leased by the Kingston Shipbuilding Co., the latter being somewhat in the nature of a subsidiary of the Collingwood Shipbuilding Co.

Dominion Bridge Co., Montreal, P.Q.

The Dominion Bridge Co. in addition to active participation in munitions production on its own behalf and that of its subsidiaries has also interested itself to a very great extent in the marine engineering side of the shipbuilding activity now so widespread throughout the Dominion. Not only has marine engine and boiler building been undertaken on a big scale, but an interest has been secured in the International Engineering Works, Amherst, N.S., where marine engine work has been in progress for some several months. Judging from the enterprise record of Dominion Bridge in the past, it may not be too much to expect that before the coming year is very old the scope of operations on marine specialties will tend to dwarf in many instances otherwise effort.

AUXILIARY POWERED SCHOONER LAUNCHED

WITH the Governor-General, the Duke of Devonshire, Lieut.-Governor Barnard and a host of other notables looking on, the auxiliary wooden schooner Beatrice Castle took the water on the morning of November 23 from the launching ways at the Cameron-Genoa shipyards.

Workmen engaged in shaping the big wooden hulls on adjacent slips paused while the vessel, released from the holding wedges, received its baptism of the sea, and, with hats raised, cheered lustily as the schooner, with bunting and the Union Jack waving, backed out into the Inner Harbor and was taken under escort by the waiting tugboats. The Beatrice Castle was the sixth and last schooner built under contract with the Canada West Coast Navigation Co.

The ceremony took place at 9.45 in the morning, and several minutes before the scheduled time the car carrying His Excellency and Lieut.-Governor Barnard, with Mrs. Barnard, and H. J. Muskett, his private secretary, reached the yards. The Governor-General's suite, composed of Lord Richard Neville, Col. Henderson and Capt. Rivers-Bulkley, also witnessed the launching. When the final blocks were cleared away Mrs. H. W. Brown broke the traditional bottle of champagne across the bow of the retreating vessel.

General Specification of Standard Wood Steamships

By courtesy of the Shipping Department of the Imperial Munitions Board, Ottawa, we are able to place before our readers a comprehensive resumé of the hull and equipment features of the standard wood steam freighters now under construction at various locations on our ocean coasts and inland waterway shores. The text matter in conjunction with the illustrations cannot fail to create the impression that eminently seaworthy and useful craft will be the outcome of this emergency enterprise aside from the non-permanency of the industry.

WOOD steamship construction on behalf of the Imperial Munitions Board, Ottawa is at the moment being prosecuted with considerable vigor in Eastern and Western Canada. Twenty-seven of the particular type vessel are building in British Columbia and nineteen others are distributed among shipyards between Toronto and the Atlantic seaboard. Leading dimensions of these standardized craft are as follows:

Hull Dimensions.

Length B.P.	250 ft.
Length O.A.	259 ft.
Breadth, extreme	43 ft. 6 in.
Breadth, moulded	42 ft. 6 in.
Depth, moulded	25 ft.
Depth over keel	26 ft. 11 in.
Draft for displacement	22 ft.
Draft over keel	21 ft.
Approximate deadweight on 20 ft. maximum draft	2,500 tons
Approximate deadweight on 21 ft. maximum draft	2,800 tons

General Description.

Vessel will be of the single deck cargo type, built principally of Douglas fir, with hold beams, wood deck houses and rails. To have elliptical stern with long poop deck aft, and raised fo'c'sle forward. To have five hatches. One deep ballast tank with longitudinal divisions. To have six watertight wooden bulkheads, one bunker bulkhead, which is a non-watertight bulkhead, one screen bulkhead, and one watertight door between engine room and tunnel.

Accommodation for the officers will be in deck houses erected on the poop deck. A bridge and bridge house will be erected at the forward end of the poop.

Six cargo winches, one of which is to be a warping winch, to be fitted as shown on deck plans. Windlass on the fo'c'sle head suited to handle anchors and full scope of chain, also arranged for warping as usual.

Fore peak to be fitted for fresh water, with filling pipes, suctions, etc. After peak to be fitted in the same manner. Culinary water will be distributed from separate steel tanks of about four hundred gallons capacity each, placed as directed.

The vessel is to be driven by single screw, with engines abaft, amidships, as shown in the drawings. Builders of hull will have no responsibility in connection with the installation of machinery, except in the putting in of foundations for the main engines and auxiliaries, for deck gear, and in the piercing of hull for sea cocks, valves, etc., as directed by the Board's representative, and also in the fastening of deck machinery, deck fittings and windlass.

Classification.

The vessel is to be built to Lloyd's requirements for A1 classification, and to the requirements of the British Board of Trade, as far as necessary for a cargo steamer.

Materials.

All lumber used in the construction to be British Columbia fir, generally known as Douglas fir, unless otherwise specified. All material to be to the satisfaction of the Board's inspector.

Long lengths are to be used in the keels, keelsons, planking and ceiling, and to be clear of shakes, loose knots and other faults, and, as far as possible free from sap. All decking to be edge grain.

Fastenings to be treenails, screw bolts, and drift bolts of galvanized iron and black iron, as hereinafter specified.

Conditions.

It is distinctly understood that the builders are to supply the Board with a hull constructed in a workmanlike manner, satisfactory for ocean service and fitted in all respects for the safe handling of freight. The work in all departments shall be done under the supervision and subject to the approval of the Board's inspector, and facilities must be afforded him for inspecting material and workmanship during the whole progress of building.

Drawings and Plans.

The drawings and plans to be used in connection with the construction of the vessel will be supplied by the Imperial Munitions Board during the progress of the work, and if the contractor is in doubt as to the method of construction or fastening, he is to call upon the inspector, who will at once see that he is provided with the necessary details.

Water-testing of Compartments.

Fore and after peaks and deep tanks will be tested with a head of water before launching, as instructed by Lloyd's inspector, and the representative of the British Board of Trade.

Keel.

Keel to be sided 24 in., moulded 20 in. To be in four lengths. Scarphs to be 12 ft. long, and to be copper painted before fastening. The nibs of the scarphs to be 4 in. deep. All to be fastened with 1 in. galvanized button head screw bolts, having the heads sunk below the flush for cementing before shoe is fitted. The ends of the scarphs to be spiked.

Shoe.

Shoe to be 3 in. fir in approximately 24 ft. lengths, and to be fastened with 8 in. by 7-16 in. galvanized spikes, spaced 15 in. centres, staggered. Heads of spikes to be set in, say ½ in., and cemented.

Stem.

Stem to side 18 in. and mould 18 in. The cut water at stem to be reduced to 5 in., and gradually to widen out to conform to the curve of the forefoot as it widens out to meet the keel. The rabbet of stem to be 3½ in. deep. Forefoot connecting stem to the keel to be a wide timber, moulded to the form of stem. The stem as it widens out.

The forefoot to be scarphed to stem and keel, as shown on the stem drawing which will be provided.

Apron.

Apron to side 24 in. and mould 28. To extend down until it dies on the forefoot. The apron to be connected to the stem with 1½ in. galvanized drift bolts, spaced 12 in. centres, staggered. Forefoot to be connected to stem and keel with at least four 1¼ in. galvanized screw bolts, the heads and nuts sunk below the flush to be cemented on the outside and the recess inside to allow the deadwood to lay close.

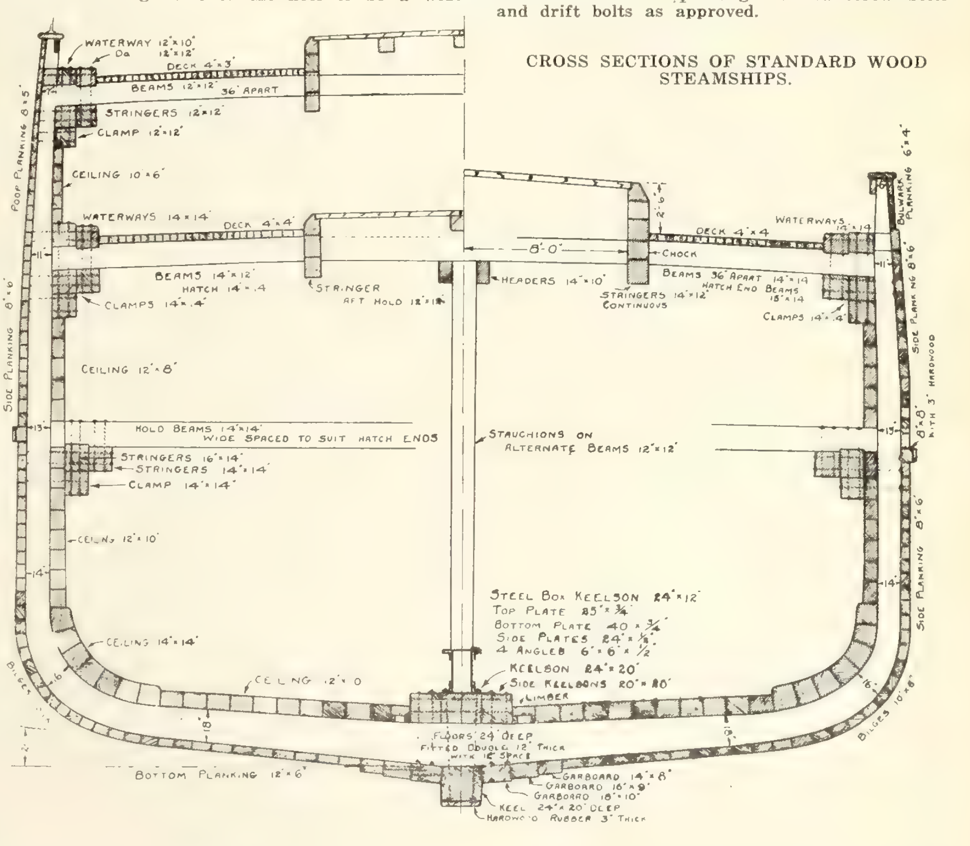
Balance of the forefoot to be fastened into the deadwood with 1¼ in. drift bolts.

Propeller Post.

Propeller post to be moulded 30 in., and generally sided 24 in. In the way of shaft tube, to be swelled out to 32 in., and tapering from the under side of the boss to 17 in. at top of keel, which will be tapered off to suit, finishing at 12 in. at rudder post. Propeller post tenoned into keel and skid log. Copper paint to be applied in mortises before fastening.

Knee.

The knee fastening keel to propeller post to be a natural crook, and both arms to be not less than 7 ft., and fitted the full seven feet along keel, the other arm to be fitted to suit height of shaft logs. Rabbett to be 3½ in. deep, and to conform to the table of rabbet measurements, which will be furnished. The keel, propeller post and knee to be fastened to each other with 1¼ in. galvanized screw bolts and drift bolts as approved.



CROSS SECTIONS OF STANDARD WOOD STEAMSHIPS.

and forefoot to be securely connected to the keel and to each other, and also to the apron and deadwood, as per detail drawing which will be furnished.

Stem Band.

An iron stem band to extend from the top of stem to beyond the keel scarph connecting the forefoot, and to widen out to suit the forefoot

Deadwood Forward and Aft.

The deadwood forward and aft to be generally 24 in. x 24 in., securely fastened to knee aft and forefoot forward with 1⅛ in. black drift bolts. The deadwood to be built high enough to come about 3 in. above the face of ceiling.

Rudder Post.

Rudder post to be 24 in. x 24 in., and gradu-

ally tapering to 12 in. at top of keel. In addition to this, the post will be rounded to an oval shape for a certain distance in way of the propeller. Detail of this will be furnished. Rudder post to be tenoned and to extend from the top of keel through to upper deck, and to be fastened to keel with $1\frac{3}{8}$ in. and $1\frac{1}{4}$ in. drift bolts.

Skid Log.

To be 14 in. x 24 in. To be tenoned into rudder post at head, to heel on shaft logs or deadwood aft.

Knees in Arch Between Propeller Post and Rudder Post.

Natural knees to be fitted in way of the arch between propeller post and rudder post, and to be very securely fastened with 1 in. galvanized drift bolts.

Plates in Way of Well.

Two cast steel, wrought steel or brass plates to be fitted around rudder post, keel, propeller post, extending forward of keel beyond propeller post. To be 2 ft. above the boss on propeller post. To be carried along the keel to cover the projecting end which receives the lower pintle. To be carried up the post a distance of approximately 2 ft. 6 in., and to extend forward of the propeller post for a distance of 2 ft. 6 in. These plates to be through bolted to one another with countersunk head bolts on one side and rivetted into countersink on the other. Detail of these plates will be furnished.

Frames.

Frames to be double, to side 12 in. and to mould 24 in. at keel, 18 in. at long floor futtock, 16 in. at the turn of the bilge, 14 in. in way of the top of thick ceiling, 13 in. in way of hold beams, 11 in. at deck and 7 in. at upper deck. Double frames to be efficiently fastened to one another with fir treenails. In way of the well deck, a single frame will run up, forming a bulwark stanchion, and care must be taken to see that opposite stanchions come on the same side of each frame. In the way of the poop and fo'c'sle, the double frames will be run up, the ends of the top timbers to be left alone, say about 2 in. in order that the covering board may be let over the frame for efficient caulking. The faying sides of frames to be coated with preservative, also futtock ends.

Swash Chocks.

To be put in along centre line for three-fifths of length, also between the bilge and keel, and to extend fore and aft as far as possible. Salt chocks to be fitted as shown on midship section. The spaces from the lowest salt chocks up to be entirely filled with salt.

Limbers to be cut in way of second garboard, to be $3\frac{1}{2}$ in. wide and $2\frac{1}{2}$ in. deep, to allow chain to be freely pulled back and forth. Frames to be spaced 3 in. centres, and to be securely held in place by a sufficient number of carefully disposed ribbands, to hold the frames in place during construction. Frames to be fastened to keel with two $1\frac{1}{8}$ in. black drift bolts in each frame.

Cant Frames.

The heels of cant frames to be closely fitted to the deadwood, and to be securely fastened to deadwood with $1\frac{1}{8}$ in. black drift bolts.

Framing at Stern

Above the knuckle, framing at stern will be after the rim type of stern, the rim extending forward to Frame No. 2, care being taken that the butts of the rim timbers be well shifted. Timbers worked to shape and connected with anchor stock pieces. Rim stern to be efficiently fastened with 1 in. drift bolts.

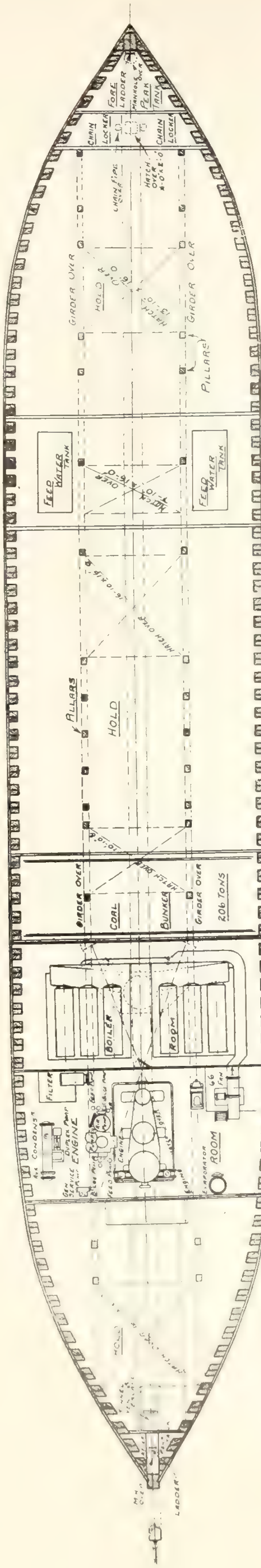
Keelsons

Wood keelsons to be three in number, centre keelson to be 24 in. x 20 in. and sister keelsons to be 20 in. x 20 in. Centre keelson to be in four lengths and scarphed with 10 ft. scarphs, and the starboard sister keelson to be in four lengths with 10 ft. scarphs. These scarphs to be similarly bolted as scarphs in keel, with 1 in. black screw bolts. Scarphs to be coated with preservative.

A steel rider keelson is to be fitted on top of the wood keelsons, as shown in cross section. The steel keelson, centre and sister keelsons, frames and keel, have to be fastened with through screw bolts of $1\frac{1}{4}$ in. galvanized and black iron, as per drawing of fastenings which will be furnished. In addition, the wood keelsons are to be edge bolted with one $1\frac{1}{4}$ in. screw bolt in each space between frames, as per drawing which will be furnished. Plate washers will be fitted to the keelson screw bolts at top, where washer rests on wood. Plate washers will be fitted both under heads and under nuts of edge bolts, as per drawing. The steel keelson will extend from the fore peak bulkhead to the after peak bulkhead, and will be constructed with a wide foundation plate having a built-up box girder 12 in. wide and 24 in. deep, riveted to centre of foundation plate. The steel keelson will be supplied by owners, and erected by contractors. Steel to be well painted with non-corrosive paint before fastening to wood keelsons.

Shaft Logs

Shaft logs to be 36 in. square, built in two pieces, 36 in. x 18 in. and fitted in position to



STANDARD WOOD STEAMSHIPS BUILDING IN CANADA SECTIONAL PLAN UNDER MAIN DECK.

suit shafting, heights of which will be given later. The two sections of shaft logs to be bolted to one another with $1\frac{1}{8}$ in. black screw bolts. At the forward end of shaft logs, two hardwood, logs, 12 in. x 18 in., are to be fitted running from side to side of vessel, and to be let in over end of shaft log 8 in. To be securely fastened to hull and shaft logs with $1\frac{1}{8}$ in. drift bolts. The bolting in the way of propeller post, shaft logs and hardwood cross timbers to be so disposed that in the final boring out of the tube, there will be no iron interfering. The size of tube will be furnished the contractors.

Ceiling

Bottom ceiling to be 12 in. x 10 in., in long lengths, having a limber strake fitted adjacent to the sister keelsons, as shown on midship section. Ceiling to be neatly fitted on edges, so as to lay close, particularly at back. In the way of the deep water tank, the liber strake is to be solid. Ceiling to be edge and face bolted with $1\frac{1}{8}$ in. black drift bolts. There are to be four bolts in every plank in every frame, to be driven from the outside and clinched. These bolts to be well headed over clinch rings to prevent drawing. The edge bolts to be $1\frac{1}{8}$ in. black drift bolts, spaced about 4 ft. 6 in. centres, and to be long enough to go half way into the next plank but one below.

Limber Chains

In the way of the limber strake, chains are to be fitted in lengths which will be indicated on drawings. to be $\frac{1}{2}$ in. chain, short link, galvanized.

Thick Ceiling in Way of Bilge

Ceiling in way of bilge to be 14 in. x 14 in., and to be similarly fastened as above.

Ceiling Above Bilge Ceiling

Ceiling directly above bilge ceiling to be 12 in. x 10 in., extending to above the hold beam stringers. To be similarly fitted and similarly bolted.

The remainder of ceiling to the under side of maindeck stringers to be 12 in. x 8 in., similarly fitted and fastened.

Ceiling in 'Tween Decks

To be 10 in. x 6 in., and to be similarly fitted and similarly fastened.

Hold Beam Stringers and Clamps

To be 16 in. x 14 in. and 14 in. x 14 in. To be fastened with $1\frac{1}{8}$ in. galvanized screw bolts, four in each frame, through both stringer and clamps, and to be edge bolted with $1\frac{1}{4}$ in. galvanized screw bolts, through hold beams, four in each end of each beam, and the top and bottom chord to be through edge bolted to one another with $1\frac{1}{4}$ in. galvanized screw bolts, spaced about 2 ft centres.

Maindeck Stringer and Clamps

To be 14 in. x 14 in., similarly fastened to the hold beam clamps, with $1\frac{1}{8}$ in, galvanized screw bolts.

Waterways on Maindeck

To be 14 in. x 14 in., the inboard waterway to be jogged to the beam as shown on drawings, and to be fastened with two $1\frac{1}{8}$ in. galvanized screw bolts, in each frame, and to be through fastened with two $1\frac{1}{8}$ in. galvanized screw bolts through frames and outside planking.

Maindeck waterways, stringers and clamps to be edge bolted with one $1\frac{1}{4}$ in. drift bolt, through waterway, beam, clamps and into ceiling below, and one $1\frac{1}{4}$ in. screw bolt through waterway, beam and upper and lower chords of clamps, and the inner waterway and inner clamp to be edge bolted with two $1\frac{1}{4}$ in. bolts.

Upper Deck Stringer and Clamps

Upper deck stringer and clamps to be 12 in. x 12 in. To be similarly fastened to maindeck clamps and stringers with $1\frac{1}{8}$ in. galvanized screw bolts. To the edge bolted through deck beams and upper and lower clamps with one $1\frac{1}{4}$ in. drift bolt in each beam at each end, extending into ceiling below, and to have one $1\frac{1}{4}$ in. galvanized screw bolt in each end of each beam through beam and inner member of clamps.

Air Spaces

A 3 in. air course to be fitted for one-fifth of the entire length of the vessel each end, between keelson and hold beam clamps, as shown on midship section. A 3 in. air course the full length of the vessel to be fitted under hold beam clamps as shown on midship section. Between maindeck beams and upper deck beams, chocks 5 in. deep are to be fitted as shown on midship section, leaving air spaces as indicated.

Outside Planking

First garboard to be 18 in. x 10 in., with 5 ft. scraphs. Second garboard to be 16 in. x 9 in., and third garboard to be 14 in. x 8 in. Bottom planking to be 12 in. x 6 in., bilge planking to be 10 in x 6 in., side planking to be 8 in. x 6in. up to the guard. Top side planking to be 8 in. x 5 in. Garboard strakes to be fastened with four $\frac{7}{8}$ in. galvanized bolts, spaced about 3 in. centres. Bolts to be 32 in. and 20 in. long. The bottom and bilge planking to be fastened with three treenails and a galvanized spike in each frame, and galvanized butt bolts.

The 8 in. x 6 in. and 8 in. x 5 in. planking to be fastened double and single.

Treenails to be driven through and wedged with 1⅜ in. oak wedges. All short treenails up to 12 in. in length to have a wedge inserted in point before driving. All holes striking iron less than 8 in. in frame to be plugged and another hole bored. All holes above waterline to be plugged. All holes below waterline to be plugged and cemented.

Guard

Guard to be 16 in. x 9 in., fitted as shown on midship section, and to be securely fastened to frames with ⅞ in. drift bolts. A hardwood rubbing strake 3 in. x 6 in. to be fitted on face of guard, and securely spiked. Heads of spikes to be driven in and holes plugged.

Covering Board at Upper Deck

Covering board to be 5 in. x 18 in., grooved on under side to receive the projecting heads of frames. Covering board to be securely fastened to chocks, frames and outside planking. Covering board to be rounded on outer edge as shown on midship section.

Rail in Way of Bulwarks

Rail in way of bulwarks to be 6 in. x 20 in. To be grooved on the under side to receive the heads of stanchions. To be rounded both on the inner and outer edges as shown on midship section. A 3 in. x 9 in. fore and aft plate to be fitted under the rail, and to be well fastened to stanchions and rail with spikes.

Beams

Hold beams to be 14 in. x 14 in., spaced as shown on inboard profile. To be secured to clamps and stringers with screw bolts as already described.

Main Deck Beams

To be 14 in. x 14 in., at amidships, running to 10 in. x 14 in. at ends, 5 in. worked and 4 in. sprung, spacing 36 in. Detail of beam ends will be furnished. Beams to have a camber of 9 in. amidships. Beams in way of hatches to be 14 in. x 15 in. from forward to the after end of engine room casing. Aft of the engine room casing, main deck beams will be 12 in. x 14 in., and hatch beams 14 in. x 14 in.

Upper deck beams to be 12 in.x 12 in., 36 in. centres, and beams in way of hatches to be the same width as the corresponding hatch beams below, by 12 in. deep.

Main Deck Hatch Coamings

Main deck hatch coamings to be 12 in. x 14.in. and to be notched into beams in way of hatches a distance of 2¾ in., as indicated on midship section and details.

Carlins in way of hatches to be notched into coamings 2¾ in. as indicated on drawings.

Four 2 in. rods with plate washers and turnbuckles to be fitted in hatchway at each side, as indicated on drawings.

Upper Deck Hatch Coamings

Upper deck hatch coamings to be 12 in. x 12 in., notched into deck beams in a similar manner to main deck. Carlins in way of upper deck hatches to be notched into coaming in similar manner to main deck beams. Upper deck beams and carlins to continue to outside of frame as shown on midship section, the heads of frames being notched out for this purpose.

Lodging Knees

Carlins to be secured to hatch coamings by lodging knees 8 in. deep, fitted as shown on drawings. To be thoroughly bolted to both carlins and hatch coaming with 1⅛ in. drift bolts, clinched.

Continuous Stringer Under Main Deck Beams

A continuous fore and aft stringer to run under deck beams below hatch coamings. To be 12 in. x 14 in.; to be scarphed with 5 ft. scarphs. Scarphs to be fastened with 1 in. black screw bolts and stringer to be securely bolted to beams with 1⅛ in. drift bolts, two bolts in every beam.

Side Keelsons

Two side keelsons 12 in. x 16 in. to be fitted to ceiling directly under the continuous stringer and to be continuous. To be scarphed, and scarphs secured with 1 in. screw bolts.

Continuous Stringer Under Upper Deck

Continuous stringer under upper deck to be 10 in. x 12 in., and scarphed and fastened to deck beams in similar manner as main deck stringer.

Pillars

Quarter pillars 12 in. x 12 in. to be fitted between the slide keelson and the continuous stringer under main deck beams. Pillars to be as shown on inboard profile. The heels and heads of pillars to have hardwood bearing strips fitted. Hardwood to be 5 in. thick at heel and 3 in. thick at head. Pillars to be secured to side keelson at heel with plate straps ½ in. x 12 in., 3 ft. 6 in. long, securely bolted to one another and to pillars. Heads of pillars to be fastened with an 8 in. knee each side of pillar. Knee to be securely fastened to pillars and to stringer with 1⅛ in. black drift bolts.

Upper Deck Pillars

To be 4 in. x 8 in., extending from top of continuous coaming on main deck to underside of stringer on upper deck. Pillars to be fastened as shown on inboard profile.

Continuous Coaming on Main Deck

To be constructed of three courses of 12 in. x 12 in., in way of hatches, and two courses between hatches as indicated on midship section. Lower member to rest on top of beams and hatch coamings, and all to be securely bolted to beams and to one another with 1⅛ in. black drift bolts. Top member of coaming in way of hatches to be notched out for hatch cover, as indicated on midship section.

Cross Coamings on Main Deck

Cross coamings in way of hatches to be laid on top of desk, and to be 12 in. thick at bottom; the upper courses are narrowed to form landing for fore and afters. See detail.

Upper Deck Hatch Coamings

To be similarly constructed to main deck coamings and similarly fastened. To be in two courses of 10 in. x 12 in. Upper courses to be notched for hatch covers in a similar manner to main deck hatches. These coamings only run two beam spaces beyond the hatch opening. Cross coamings to be similarly fitted on top of deck to those on main deck.

Hatchways

All hatchways to be lined with ⅛ in. steel plate with a 2 in. half-round chafing iron at bottom. The 2 in. half-round chafing iron in a fore and aft direction will not register with the one running athwartships, as the continuous stringer under the deck beams running fore and aft make the whole coaming at side deeper than at ends. In order to keep a line from fouling, the half-rounds on the fore and afters are carried beyond the ends of hatches at both ends, for a distance of 2 ft., as will be indicated on drawings.

Hatch Shifting Beams

Shifting beams 18 in. x 14 in. to be fitted in hatchways as shown on drawings. A ½ in. x 7 in. stirrup plate is to be fitted at ends of shifting bases and the ends of shifting beam will rest in angle sockets. There will be bearing plates ½ in. thick fitted on top of shifting beam to receive the fore and afters.

Hatch Fore and Afters

Hatch fore and afters to be one 18 in. x 16 in. notched out at top for covers, and two 14 in. x 14 in., tapered to suit the rake of covers. These fore and afters will have ½ in. x 7 stirrup plates fitted on the ends, and they will rest on bearing plates fitted on the cross coaming. The ends of the fore and afters will rest in single sockets. See detail.

Wood Hatch Covers

To be 3 in. thick and constructed out of two pieces 5½ in. x 13 in., through bolted to one another with three ⅝ in. bars clinched in the usual manner. These bars are to be driven as indicated in detail, so that the bars may form the means of breaking away the hatches as well as the means of lifting the covers off.

Hatch Cleats and Battens

Hatches to be fitted with cleats spaced 2 ft. centres, and to be fitted with bottoms at least ¾ in. thick, and the usual wedges, all as per detail.

Deep Tank Hatches

Deep tank hatches are to fitted with one course of 12 in. x 12 in., and 8 in. x 5 in. channel bars on top of the 12 in. x 12., with ⅝ in. steel watertight covers as will be shown in detailed drawings.

Bulkheads

There will be four ordinary watertight bulkheads, one forward of bunker, one at the after end of engine room, one at the after deck, and at the collision bulkhead. These are to be constructed of two thicknesses of 3 in. lumber, laid diagonally and fitted between the two diagonal courses with canvas, painted with marine glue, to approval. The boundary timbers will be 7 in. x 7 in., fitted on both sides of the bulkhead and the vertical stiffeners will be of timber 3 in. x 5 in. spaced 18 in. centres. These bulkheads are to be made watertight, and the details of construction will be furnished. There will be a bulkhead at the after end of bunker which will be similarly constructed, but having no canvas between the courses. This bulkhead will be fitted with the necessary openings for access to coal. The vertical stiffeners instead of being spaced 18 in. apart will be 30 in. apart. In addition to the above, there will be constructed two special bulkheads fitted as a deep tank. These will be constructed of two thicknesses of 4 in. lumber, laid diagonally with canvas between, arranged to approval. The boundaries will be 7 in. x 7 in., on both sides of the bulkhead, and the wood stiffeners will be 6 in. x 4 in. spaced 18 in. centres. Details of these bulkheads will be furnished. In the deep tank, a fore and aft centre line bulkhead will be constructed of 8 in. lumber, fitted with lightening holes. The construction of these bulkheads will be detailed. Fore and aft bulkhead will be fastened with drift bolts, and the other bulkheads will be fastened with spikes, to approval. Screen bulkheads to be fitted as and where directed.

Decking

Main deck planking will be 5 in. x 5 in., finishing about 4½ in. x 4½ in., of clear, straight, edge grain fir. The upper deck will be 4 in. x 4 in., finishing about 3½ in. x 3½ in., clear, straight edge grain fir. The main deck to be fastened with 7/16 in. x 8 in. galvanized spikes, two in each strake in each beam. The upper deck to be fastened with ⅜ in. x 7 in. spikes, two in each strake in each beam. These spikes to be reeled and plugged, with plugs set in white lead. Decking to be in lengths 20 ft. and 40 ft., averaging 30 ft., and should be cut as soon as possible for air drying before being laid. The edges of decking to be bevelled for caulking, care being taken that the bevels leave the vertical grain up. Decks to be payed with marine glue.

Pointers

Two sets of pointers forward, and two sets aft to be located in suitable positions to give strength. To be 12 in. x 18 in. in order to mould to a suitable size. To be connected at heels with a natural crook. Pointers to be fastened with 1⅛ in. drift bolts. Six bolts to be in every frame, clinched, and all bolts to be driven before outside planking is put on. Pointers should span four frames.

Breast Hooks

To be natural knees fitted forward 12 in. thick, to approval. Arms to be long enough to provide efficient fastening through frame. Throats of hooks to be well fastened into stem with 1½ in. bolts and face of arms to have ten 1¼ in. bolts, and bolts to be clinched.

Knees

Knees will be fitted at head of hold pillars. To the 8 in. knees, one arm 2 ft. long, and the other arm 3 ft. long. Similar sizes knees will be fitted as lodging knees in the way of all openings, and similar knees both hanging and lodging, will be fitted in way of continuous stringer under deck. Hanging knees will be fitted under the fo'c'sle deck beams at ends. These knees to be 10 in. knees, length of one arm 3 ft. and the other arm 4 ft. The knees will be fastened with 1⅛ in. drift bolts, clinched. Hold beam lodging knees to be fitted as directed, length of one arm 3 ft. and the other arm 4 ft. Knees to be 6 in. at ends, and 18 in. at throat. Knees to be 12 in.

Knightheads

Knightheads to be fitted in way of stem and stern for a distance of approximately 6 ft. 6 in., as indicated on drawing.

Horn Timbers

Horn timbers to extend from deadwood to after end of vessel. To be two in number 12 in. x 12 in. To be securely fastened to skid log, rudder post and frames, all to approval. Filling-in pieces to be fitted between horn timbers and skid log. Fastening to be 1⅛ in. drift bolts.

Construction in Way of Engine and Boiler Room

Spaces between floors in way of engine and part of boiler room will be filled in solid from long floor to long floor timber and the lower edge of these filling pieces should be bevelled off to allow water to run to limbers, and in addition thereto, fore and aft timber will be fitted to the height of the top of steel rider keelson, extending from after bunker bulkhead to bulkhead at after end of engine room. The fastening of this timber is to be governed in large measure by the holding down bolts necessary for the engine bed, so as to clear holding down bolts. Fastening to be 1⅛ in. black drift bolts. Floor in engine room to be sheathed with 5 lb. lead and boiler floor with bricks.

The fore and aft timbers in the engine and boiler room are aranged to form engine and thrust seating, details of which will be furnished.

Decking Over Shaft Tunnel

A deck to be laid over shaft tunnel to form bottom of after hold. Decking to be 10 in. x 4 in., with 2 in. sheathing in way of hatch.

Deck Beams Over Tunnel

To be 6 in. x 6 in., spaced 3 ft., supported with 6 in. x 6 in. pillars, one pillar on every beam and four rows of pillars to be fitted if possible.

Seatings for tunnel bearings to be fitted in tunnel as directed.

Bulkhead at Forward End of Poop

To be built up solid of 5 in. lumber, as indicated on drawing. There will be an opening in this bulkhead, which will be detailed.

Bulkhead in After End of Fo'c'sle

This bulkhead to be built of solid 5 in. lumber. There will be openings in this bulkhead for access to the fo'c'sle. Details of these will be furnished.

Casing Around Engine and Boilers

The casing around engine and boilers in the 'tween decks will be built of solid 4 in. lumber, as indicated on drawings. To be well fastened to one another with 1 in. drift bolts.

Chain Locker

A chain locker to be fitted as shown on drawings aft of the collision bulkhead. To be of such size as will safely stow the chain. Eye plates for securing the ends of cable to be fitted in chain locker.

Small Hatches

Small hatches to be fitted to give access to the fore peak bulkhead, chain locker and after peak bulkhead.

Ladders

Ladders to be fitted to give access to all holds and tanks.

Watertight Door

An iron watertight door to be fitted in the after engine room bulkhead, to give access to the tunnel. This door will be detailed.

In the engine room bulkhead, an opening will be cut out as directed, for the purpose of enabling the condenser tubes to be drawn.

Freeing Ports

Freeing ports to be cut in way of the well deck, as approved, and to requirements of Lloyd's.

Construction of Fo'c'sle Head

Fo'c'sle head to be built up solid to receive the rail, and bow chocks to be fitted in this solid timber, as indicated.

is left between the deck and the top of the filling-in piece. These mast partners must be through bolted from one side to the other and securely fastened to the deck beams with 1⅜ in. screw bolts. Thickness of lumber to be 10 in.

Derrick Posts

In way of No. 3 Hatch, abaft the officers' quarters, derrick posts will be fitted as indicated.

Derricks

Dericks will be fitted as shown on rigging plan, capable of handling five tons. To have all irons fitted to details which will be furnished.

Crutches For Booms

Crutches for boom rests to be fitted where arranged, and to be built as detailed.

Ventilators

15 in. ventilators to be fitted in cargo holds ventilation, an air space will be left in the way of the bunkers in the strake of ceiling one below the bottom of this air space. The floors in the way of bunker will be levelled to the top of the wood side keelsons under heels of pillars, and covered with sheet iron.

Hawse Pipes

Hawse pipes to be fitted for stockless anchors as per drawing which will be furnished. To have chafing ring on deck and cover plate.

Chain Stopper

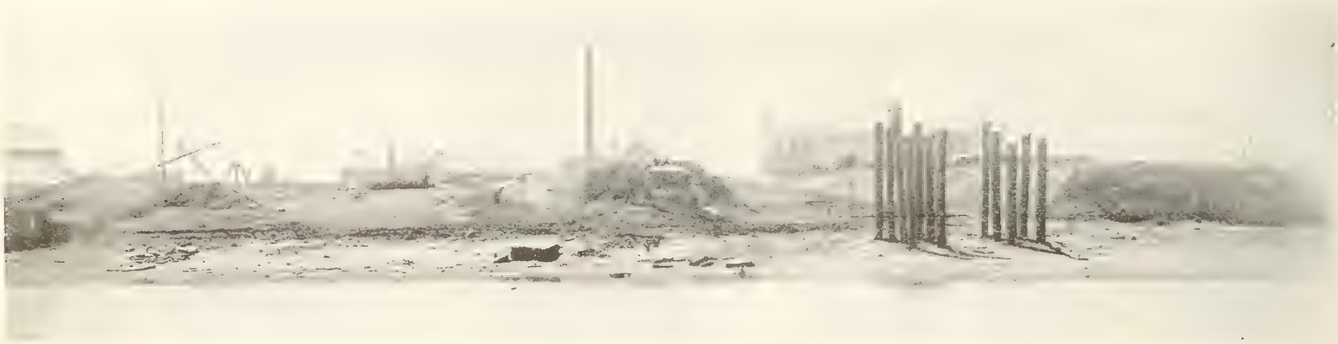
A chain stopper will be fitted in a suitable position for the cable.

Devil's Clew

A devil's clew will be fitted for the anchor cable. Detail will be furnished.

Rudder

A steel rudder to be fitted with steel stock



SHIPYARD PLANT OF THE FOUNDATION CO. AT VICTORIA, B.C.

Caulking

All outside planking to be caulked with best hand-picked oakum. Caulking to be in the proportion of one strand of oakum to each inch thickness of plank. Caulking must be well horsed and carefully done. Outside plank seams up to 10 ft. waterline to be cemented. Balance of outside seams to be puttied. Decks to be caulked with the best hand-picked oakum, in the proportion of one strand of oakum to each inch thickness of plan. To be well horsed, seams to be payed with marine glue to approval. Ceiling in way of deep ballast tank to be caulked so as to be watertight. All watertight bulkheads to be caulked where necessary, to ensure watertightness. The whole of the caulking throughout the entire vessel must be first-class in every respect, and each strand must be well hardened up before the next strand is laid.

Fastenings

Vessel to be efficiently fastened in every respect, and the fastening to conform generally to the sizes stated in the various items hereinbefore mentioned.

as indicated on drawings, and in way of deep tank, swan-neck ventilators to be fitted as indicated on drawings.

Hawser Pipes, Fair-leads and Bollards

Hawser pipes, fair-leads and bollards to be fitted as indicated on drawings, and to be securely fastened.

Ports

Port lights to be fitted in fo'c'sle as directed. These lights to have 10 in. clear glass.

Accommodation Ladder

Accommodation ladder with all fittings, tackle and gear necessary for shipping ladder on either side of vessel. Ladder to be made of wood. All fittings to be galvanized. Suitable platforms with necessary fittings to be provided for landings. Ladder can be made in two sections if required.

Beds For Windlass, Winches and Steering Engine

Beds for windlass, winches and steering engine to be laid as directed, and to approval. Any extra stiffening required in way of these to be fitted as directed.

having steel gudgeons and pintles. Gudgeons to be lined with lignum-vitae, all as per drawing which will be furnished.

Machinery Spaces

Machinery spaces are to be lined with ¼ in. wrought iron, properly secured, in the way of all parts of woodwork exposed to risk of fire. In general terms, the stokehold will require to be completely sheathed and such parts of the engine room as will be indicated by the Board's Inspector.

Scuppers

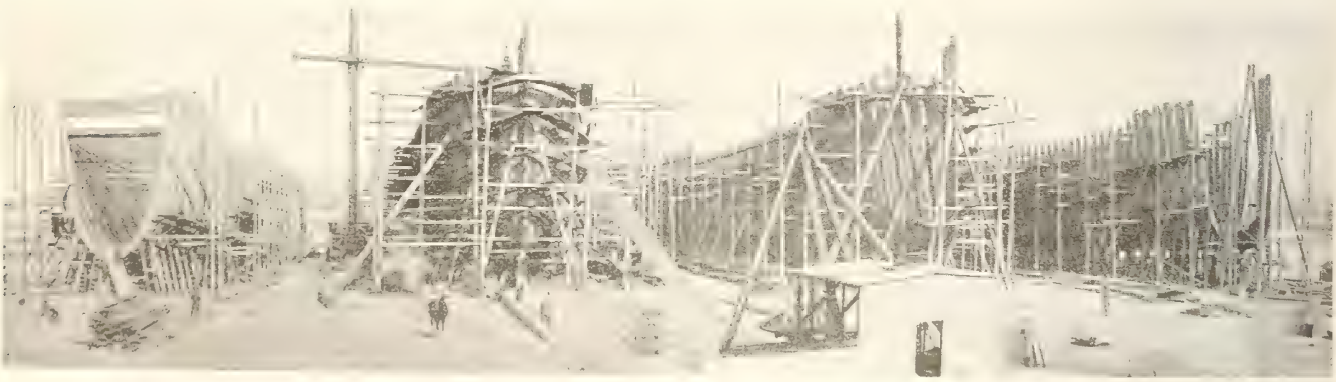
Scuppers to be led through waterway as indicated on drawings. Of lead pipe 4 in. in diameter. To be flanged both outside and inside and securely fastened with galvanized clout nails.

Accommodation For Crew

Accommodation for crew to be fitted in fo'c'sle as indicated on drawings. To be plainly but substantially built, and to have suitable lockers fitted. Berths to be open iron berths of suitable pattern.

Chain Pipes

Chain pipes to be led through fo'c'sle in proper



STANDARD WOOD STEAMSHIPS UNDER CONSTRUCTION AT THE YARD OF THE FOUNDATION CO., VICTORIA, B.C.

Masts

Two pole masts or derrick posts as arranged to be fitted of a suitable diameter, to carry sets of derricks capable of handling five tons. If masts are fitted, all mast irons, irons for derrick heels, rigging, rigging screws, chain plates, forestays and backstays to be fitted to approval, and as indicated on drawings. Masts to be stepped as indicated on plan, and to approval. All mast irons and other blacksmith work will be furnished by the Board and fitted by the contractor.

Mast Partners

To be fitted in way of masts, and to be filled in solid 5 ft. each side of the mast, and pieces inserted into the adjacent beam. These filling-in pieces are to be so fitted that an air space

Beds For Auxiliary Machinery, Etc.

To be installed and fitted as and where directed.

Bunker Spaces

Bunker spaces to be lined with 1¼ in. ceiling laid on grounds 3 in. thick, to form air spaces. This ceiling to be covered with ⅛ in. black iron sheets, to protect same. All spaces intenuded for use as bunkers to be so fitted with air spaces and sheeting. Ventilation of bunkers to be very closely considered and carried out to approval. Sides of bunker below hold beam clamps will have air space shown on midship section immediately below the clamp as a means of ventilation. The 3 in. air space will not be worked around the hold beam clamps, but will cease directly under the clamp. Air space above the clamp will extend to the main deck beam clamps, and for

location to suit windlass. To be of sufficient diameter to allow chain to stow freely. Drawings of this will be furnished.

Plumbing the Fo'c'sle

Plumbing in fo'c'sle will be plain but substantial, and great care must be taken with this particular work.

Coaming on Top of Covering Board Around Upper Deck

A coaming 4 in. x 6 in. to be fitted on top of covering board as shown on midship section, to receive stanchions.

Joiner Work

Accommodation for officers, and officers' dining room and pantry, to be erected as shown on plan. Officers' and engineer' rooms to be fitted in good cargo boat style. Rooms to be fitted

with spring berths, hardwood front, upholstered settee, desk, drawers and folding lavatory. Floor laid with linoleum and carpet runner.

Dining saloon to be panelled in hardwood and fitted with tables, swivel chairs, sideboards, etc., as usual in vessels of this class. Pantry to be fitted up with hot press and all necessary shelving. Details of the construction of this house will be furnished.

In the way of engine room casing, galley crew's messroom, storerooms, ice house, officers' bath and W.C., engineers' bath and W.C., petty officers' bath and W.C., wireless room, room for cook and boy, and room for petty officers, will be fitted. Galley will be lined with galvanized iron, fitted on 1½ in. grounds, leaving an air space all round. Galley to be fitted with stove shelving and all necessary fittings. Galley funnel to be fitted as directed.

Crew's Messroom

Crew's messroom to be fitted in plain manner, with benches, table and all necessary shelving.

Storerooms

Storeroom to be fitted aft on main deck. To be provided with shelving to approval. Storeroom on upper deck to be fitted with drawers and shelving as directed.

Ice Box

Ice box to be fitted and properly insulated. Shelving to be sheathed with galvanized iron, all as per drawing which will be furnished.

Baths and W. C.

To be provided for officers and engineers, with water supply, etc., to approval. Plumbing must be efficiently and carefully done.

Wireless Room

Wireless room to be fitted with berth, drawers, etc., similar to officers' rooms.

Petty Officers' Rooms

To be fitted with drawers, etc., plainly but substantially built. Rooms for gun crew to be fitted aft on main deck as indicated on drawings. To be fitted with spring berths, drawers, settees and folding lavatories as directed.

Port Lights

Port lights in officers' quarters to be brass throughout, showing 14 in. clear glass, and lights in the way of engine room casing to be of iron body with brass frame, showing 12 in. clear glass.

Engine Room Casing in Way of Rooms

To be built as indicated on drawings, detail of which will be furnished. Bulkheads between rooms will be double-tongue and groove, laid diagonally, as will be shown in details.

Back beams and carlins over accommodation will be 5 in. x 3 in., spaced generally 21 in. centres, and arranged so that deck beam, outside stud, stud in engine casing, and coaming will all register in way of bulkheads, so that bulkhead can be securely fastened and set as a brace.

Stanchions

4 in. turned stanchions to be fitted around poop and fo'c'sle decks, spaced generally 4 ft. centres. Short stanchions running to rail to have hole bored through centre to allow a ⅝ in. rod to pass through. Long stanchions running to the deck will have through rods fitted where directed alongside stanchions. Short stanchion rods are bolted through rail, coiling and covering board. Long stanchions rods bolted through plates, rail, ceiling and covering board. Plate at head of stanchions to be 4 in. x 6 in. The ends of carlins and deck beams to be dovetailed into place as will be shown on details.

Rail

A suitable rail to be fitted having fore and aft runners between rail and deck as shown in drawings.

Decking Over Accommodation

To be 1½ in. T. & G. 3¼ in. face, planed smooth- V-jointed on the under side, and to be covered with felting and canvas. Canvas to be No. 2, having drilling bedded in white lead under the joints of canvas. Joints of adjacent strips of canvas to be closely butted over drilling and to be nailed with double pointed galvanized tacks, spaced about ⅜ in. apart. Canvas to be thoroughly stretched before being nailed. This work must be carefully done in order to ensure a tight deck.

Immediately canvas is laid, it should receive a coat of paint, and should receive in all four coats of paint. Covering board for canvas to be 1¼ in. x 8 in., fitted with bead outside. Waterway in way of covering board to be laid in lead as shown in details.

Skylights

Skylights for engine room to be built of teakwood as directed, and to detail. To be fitted with approved opening gear.

Ventilators

Accommodation will be fitted with mushroom ventilators, details of which will be furnished.

Bunker Rings

Bunker rings to be fitted on upper deck, as shown on drawing, and to detail.

Coal Chutes

Coal chutes to be fitted in engine room casing as directed, with suitable doors for coaling 'tween decks. Detail will be supplied. The cross bunker will have the hatch forward of boiler casing fitted as coaling hatch, as shown on drawings.

Fidley Top

To be constructed as directed. To be fitted with angles and gratings, according to drawings which will be furnished.

Stokehold Ventilators

Stokehold ventilators of ample diameter to be fitted as directed and to have approved turning mechanism, all to detail.

Engine Room Ventilators

Ventilators of ample diameter to be fitted in engine room in an approved manner.

Bridge, Pilot House and Captain's Room

A bridge to be fitted over the officers' accommodation, with pilot house, captain's room and sitting room, and chart room erected thereon. The whole of this work to be built to detail, which will be furnished.

Rail Around Bridge

A suitable rail to be fitted around bridge.

In the erection of the pilot house and officers' rooms below, care must be taken that no iron fastening of any kind is used, within a radius of 12 ft. of the compass.

Davits

Davits to be fitted suitable for the boats they have to carry. Steps, crances and all gear necessary for the correct fitting of the davits to be installed. Davits to be fitted with guys, blocks and life lines required by the Board of Steamship Inspection and the Board of Trade. There will be two sets of davits fitted to life boats, one on each side of the vessel, and one set of davits on one side for an approved working boat. Davits will be furnished by the Board.

Boats

Two Class A life boats to the British Board of Trade requirements to be fitted, one on each side of the vessel, of dimensions required by regulations. Each boat to be capable of taking the whole of the crew of the vessel. A service boat to be supplied, fitted on one side of the vessel, and built to satisfy Class X requirements of the Board of Trade. Boats to be supported in davits to the requirements of the Classification Society, fitted with all necessary gear and rigging for handling same. Boats to be furnished by the Board.

Boat Chocks

Suitable chocks for housing boats to be fitted as directed and to detail.

Anchors and Cable

Vessel to be fitted with anchors and cables to the requirements of the Classification rules. Anchors to be of the stockless self-tripping class, of approved manufacture, and of weight required by rules. Cable to be of stud link type, to classification requirements, and to stow in chain locker in the upper part of the fore peak, which locker is to be fitted with drain to bilges. All to be furnished by the Board.

Steering Engine

Steering engine of approved make to be arranged directly over the rudder, with all necessary pulleys, chains, quadrants, etc., as required, to give the desired leads, and to be fitted with suitable hand gear. Control rods to be laid from the steering engine to the steering wheel on bridge, all as per drawings which will be furnished.

A house to be built over the steering engine, aft, of suitable construction, to carry a gun seating on deck. Details of this house construction will be furnished.

Ladders, Etc.

All deck ladders to be built of hardwood, fitted with cast iron treads, and toeplates, and secured by galvanized iron fastenings. Ladder rails to be galvanized iron pipe. Ladders to be fitted as and where directed, in accordance with general arrangement plan. Accommodation ladder, wooden hold ladders and Jacob's ladder, etc., to be supplied as hereinbefore mentioned.

Deck Storerooms

To be fitted with all necessary shelves, hooks, and cleats for tackle, etc.

Lamp Room

Lamp room to be lined with galvanized sheet iron, as directed, and fitted with all necessary shelves, lockers and bins as required.

Side Light Screens.

Side light screens to be fitted of regulation size, and to be placed as indicated on drawings.

Carving

Vessel's name, and Port of Registry to be carved on the stern, and vessel's name to be carved on the bow. Same to be also painted on boats, life buoys, bells, etc. The usual carving required by regulations to be carried out.

Ship's Bell

A suitable ship's bell to be installed as and where directed.

Brackets For Mast Head Lights

Brackets for mast head lights to be fitted to approval, as directed and to detail.

Aerials For Wireless

Aerials for wireless and leads to wireless room to be fitted to approval.

Heating

An efficient system of steam heating to be fitted in accommodations with approved radiators as and where directed.

Electric Light

A lighting system having a 7½ Kilowatt capacity driven by a turbine to be installed, with all fittings complete. To be laid out in suitable circuits. To have switchboard with double pole switches, ammeter, voltmeter and short circuit indicator. Sockets to conform to British standard thread and to be of the bayonet type.

Pumping

A hand pump of approved make, say Downtown, to be fitted on deck, with connection to the sea as well as to all compartments.

Scuppers

Suitable scuppers to be fitted in the way of accommodation and boat decks, all to approval.

Compasses

Stands for compass and steering wheel in pilot house, to be fitted as and where directed. Standard compass to be installed as and where directed.

Fire Service

A fire service to be fitted as arranged, and all fittings necessary for steam heating, pumping arrangements and fire service, to be installed as and where directed. A wash desk service to be fitted to the fire service as directed.

Tanks

Two fresh water tanks to be installed on boat deck as directed, of about four hundred gallons capacity each, with suction to the galley only. Additional fresh water tanks to be fitted in the wings of tunnel, having all necessary seating, etc., fitted as and where directed. These tanks to connect to pumps for boiler feed. Deck fittings for filling pipes, etc., to be fitted as and where directed.

Painting

Outside planking below load waterline to be painted two coats of copper paint. All above load waterline to have three coats of lead, and finished navy gray. All interior work to have three coats of lead paint. Interior accommodation to be finished with colors approved by the Board, varnished or polished as found necessary. All deck work, fittings, etc., to be finished navy gray. Inside of decks, clamps, etc., to be oiled and all projecting ends of fastenings and visible iron work, including steel keelson, to be painted red oxide paint.

General

It is to be understood that while in this specification, reference is made to winches, windlasses, hawser pipes, fair-leads, bollards, hawse pipes, steam heating, pumping and fire service, etc., the contractor will only do the necessary work to allow of their being installed, such as making beds, boring holes for holding down bolts, etc. The workmanship must be first-class of its kind, and all work must receive the approval of the Board's representative. All lumber exposed both inside and outside to be dressed, except the sides of the sister keelsons.

This specification does not include any equipment, ship or engine supplies, deck or engine fittings, but it is to be understood that storerooms are to be fitted for supplies on deck and in engine room, as directed, and that all fittings supplied by the Board will be installed as directed.

PROGRESS IN DRY DOCKS AND MARINE RAILWAYS

DURING the past two decades there has been great progress made in the engineering of dry docks, and particularly in the three general types, the graving or basin dry dock, floating dry dock, and the marine railway. In the first of these, with the exception of the introduction of modern electric motors, their operation is practically the same. This device has been a welcome addition to the pumping equipment. Another improvement is the adoption of the bilge block system of supporting vessels, which had its first real impetus in 1892, when the United States Government adopted the system of equipping battleships with docking keels under the bilges for supporting the ship by this means instead of relying on side shores. So far as the size of these docks is concerned, they are being built to-day from 1,000 to 1,200 feet long, where a score of years ago a 600-foot dock was considered a large one.

All-Steel Floating Dry Docks

In 1897 the Clark & Stanfield Co. had built a 10-000-ton all-steel floating dry

dock at Havana, Cuba, which was considered the last word in that type. In 1900 the first all-steel floating dry dock in America was built. This was of the Clark & Stanfield type, and its capacity was 18,000 tons. It was constructed for the United States Government. Great Britain has adopted floating dry docks for her larger war vessels, having installed two such of 32,000 tons capacity each at its most important naval stations. The German Government has an even larger floating dry dock at Kiel, the capacity of which is 40,000 tons, while at Hamburg there is one of 35,000 tons. The largest floating dry dock in America has a lifting capacity of 25,000 tons.

Marine Railways

During the past twenty years the marine railway has also come into prominence, and while there were marine railways previous to 1896 they were of a crude type, both in Europe and in this country. The type that has been most highly developed in this and other countries is the Crandall railway, named for its originator. In 1896 there were three of these railways in the United States of from 1,200 to 2,000 tons capacity and two in Canada of 2,500 tons, in addition to a number of smaller ones. In 1900 a 4,000-ton Crandal railway was built, and now there are many with a capacity of from 3,000 to 5,000 tons. In the latter type, equipped with modern electric machinery, it is possible to pick up a 5,000-ton vessel practically as she floats in the water and haul her out in less than half an hour.

NOVEL ASPECT OF U-BOAT WARFARE

THE *Times*' naval correspondent, commenting on the submarine returns on December 13, says:—The week's U-boats returns show no material change in the total number of ships sunk, but a large increase in traffic and fewer British merchant vessels unsuccessfully attacked. It would scarcely be fair to conclude from the figures that December will prove the worst month of the quarter. With the long dark nights of winter and fogs the advantage should not be with the submarine.

Speaking of the navy estimate recently, Commander Bellairs drew a picture of the submarine warfare in a novel aspect. He said in acknowledgment of the stupendous efforts the First Lord claimed the navy was making, that it should be remembered that "the stupendous effort is the defence of the country against about fifty German submarines manned by 2,000 men—for there are not more than about fifty submarines operating at this time."

It may be regarded in this way: That it should require practically all the exertions of the larger part of five great navies to deal with fifty submarines, and yet we find these submarines can meet with the success they do, is either a strong testimony for their effective use or indicates something lacking in the present method of dealing with the menace. Commander Bellairs suggests the fault rests in the employment of what he calls the "dispersed defensive system," which means that instead of hunting the U-boats when they get at sea he thinks they should be prevented from getting to sea at all.

It may be concluded the fluctuation in loss shown in successive returns varies with the number of U-boats employed rather than the successes of the Allied hunters, and that this must continue so long as the Germans are capable of producing more submarines than the Allies can account for.

JAPANESE SHIPBUILDING SUBSIDIES

H.M. COMMERCIAL Attache at Yokohama (E. F. Crowe, C.M.G.) has forwarded a translation of a Japanese law, which is of considerable interest to shipowners and shipbuilders both in Japan and elsewhere. The law relates to the suspension of shipbuilding subsidies, and was passed at a recent special session of the Japanese Diet.

Mr. Crowe writes that the Shipbuilding Encouragement Law, which came into force in 1896, and was amended in 1910, gave a powerful impetus to shipbuilding in Japan, and the advent of the European War greatly accelerated development of the industry. The unprecedented prosperity which is now ruling in shipbuilding circles in Japan can only be ascribed to the abnormal conditions brought about by the war. All the private yards have earned very considerable profits, and there is every indication that the number of shipbuilding concerns will be largely augmented in the near future.

In view of the profits now being made, the opinion has frequently been advanced that the time had come to abolish the subsidies granted to shipping and shipbuilding, and this feeling has been accentuated by the fact that within the past few months many of the vessels recently constructed in Japan have been transferred to foreign ownership, which no doubt gives rise to a belief that, under present conditions at least, when tonnage is at such an extravagant figure, the Japanese taxpayer is being taxed for the benefit of the foreigner. For the present, however, the diet in this new law has confined itself to cutting off subsidies conferred on vessels which are sold to foreign owners.

SHIPBUILDING IN B. C.

IT is possible that the shipyards of British Columbia may soon be constructing vessels for the Australian Government. Australia wants vessels, and wants them badly, and negotiations are now being carried on by the shipbuilders of British Columbia with the Government of the Commonwealth with a view to securing orders.

The cost of the material that must be applied to the completion of the ships now under construction in the province will, it is estimated, approximate $1,700,000. In order to finance the shipbuilding undertakings, actual and contemplated, the British Columbia Manufacturers' Association is endeavoring to secure from the Dominion Government what it terms a "shipbuilding loan."

B.C. BUILT SCHOONERS REPORTED SOLD

OFFICIAL announcement is being held in abeyance, but it is reported that the Canada West Coast Navigation Co. has disposed of at least nine of its twelve auxiliary schooners to the Societie Francaise Generals, which acted for the French Government in the transaction. It is said that more than a million dollars profit was made in the deal.

Several of the vessels involved in the reported deal are at sea. The Margaret Haney, first unit of the fleet launched in Victoria, is now trading off the coast of India, having made a quick voyage to Bombay on its initial charter. The Laurel Whalen, the Esquimalt, and the Malahat, are all away on their maiden voyages. The Jean Steadman and the Beatrice Castle are still tied up in the upper harbor awaiting the arrival of Bolinder engines. The Esquimalt and Beatrice Castle have been sold by the Canada West Coast Navigation Co. to other interests since completion.

LAKE NAVIGATION ENDED AS IT BEGAN

NAVIGATION on the Great Lakes ended as it began—in a hard and long fight with ice blockades. The parallel failed in one respect, however. According to the best available information, crews on ice-bound freighters at the close of navigation did not suffer from lack of provisions. At the opening of the season a number of vessels became imprisoned in Lake Superior miles from shore, and food supplies were taken to them by men who fought against terrific odds, risking their lives in trips across the ice.

One obstacle the fleet encountered at the end was the fact that the ice instead of being soft in long reaches, as was the case at the opening, was solid, and grew thicker every hour. The cold weather continued unbroken, and the channels throughout the lakes froze over almost as fast as icebreakers opened the way for the last down-bound fleets. Further delay was encountered in handling ore and coal at the loading docks. Much of it was frozen in open-top cars.

While the total tonnage handled during 1917 did not equal that of 1916, the amount of coal exceeded that of the year before. Nearly 28,000,000 tons of fuel went through, an increase over the previous year of approximately 2,000,000 tons. Total shipments of ore from the Lake Superior region were 62,498,900 tons, as compared with 64,734,198 tons in 1916. Ore shipments in December of 1917 were cut to 911,475 tons, as against 1,085,900 tons in the same period of 1916.

Disasters during the season were comparatively few, and the loss of life involved in those that did occur was small.

Dominion Wreck Commission Inquiries and Decisions

Following the proceedings of a vessel stranding or collision inquiry is fascinating alike to the mariner and landsman. Much food for thought is always available, and in not a few instances it seems well nigh impossible to reconcile our conception of disaster prevention achievement when confronted with a detailed recital of the circumstances which contribute to many marine tragedies, not only in our own waters but the wide world over.

S.S. "ALBERT Y. GOWEN" SINKING

ON Oct. 26 and 27 an investigation was held in Quebec Court House before Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Capts. Francis Nash and Chas. Lapierre into the causes which led to the sinking of the S.S. Albert Y. Gowen, whilst lying moored at the wharf or pier within the Louis Basin, Quebec, on the early morning of Aug. 28, 1917.

The owners were represented by R. Langlais, Esq., K.C., whilst the master, Eugene Fortin, had for counsel Mr. Henri Bernier, assisted by Onezine Gagnon and Mr. Alphonse Bernier, K.C., M.P.

Master's Evidence

The master, Eugene Fortin, deposed that he held Certificate No. 4195; that the Albert Y. Gowen was of 158 tons net, 330 tons gross, carrying 12 men, of American register, 29 years old, with a speed of six miles, her draft aft being 8 feet and forward 4 to 5 feet. She carried 1 officer and 2 engineers.

He stated that on the 21st of August whilst going into the basin from Levis she struck stem on against the pier at the gate; but no damage was done. He had been one month on board, receiving $8 per day. He had orders to engage a crew but had not been successful up to the date of the casualty in securing a complement. He had not remained on board as the fittings were not completed. He had slacked the ropes to allow full play to the vessel when affected by the tides. The engineer and men engaged were by the day. He had asked for a watchman whilst at Levis; but the agent had refused as a matter of economy.

Vessel Constitution

The barge, which was formerly a suction dredge, was fitted with simple engines, and carried her cargo on deck, the hold not being adaptable for cargo. He had holes cut in the deck to answer the purpose of hatches and the covers were on when he left. He avers the vessel was in excellent condition and he had no fear in taking her to Cuba. She made so very little water that he considered her tight. In order to equalize the weight placed aft, caused by the coal, he had the three wooden tanks, placed forward of the midship, filled, they each holding 18 tons.

He stated that he had taken aboard his effects, showing that he had no intention of leaving the vessel; that up to that time he had great difficulty in finding a crew; that out of a month's salary he had received only $20, though he was engaged by the day. He positively swore that upon leaving the vessel the night previous to her sinking she had but 2 degrees of a list. He could not see any other reason for her sinking than that the water found its way through a weak point at her water line.

Harvey M. Bingley, deposed, under oath, that he represented C. J. Harrah, owner of the vessel, as agent; that by profession he was a civil engineer; but for the last 20 years he had much to do with ships and knew the requirements. He positively asserted that the Gowen was not leaky before nor after the sinking, and that he had given a free hand to the master, who was duly engaged as such, and expected him to have the ship in readiness for sea. He was greatly surprised when told that the vessel had sunk; but when he proceeded to the wharf he realized the situation.

After receiving evidence from several other witnesses the court arrived at a finding as under.

Finding

The court found that the master, Eugene Fortin, was duly engaged as master of the Gowen, his name appearing in the articles as well as on a form signed before the American Vice-Consul. He was instructed to secure his crew and use all diligence in so doing. Up to the sinking of the ship at her wharf he had but partly succeeded. The vessel had been fitted with bedding, etc., and to all intents and purposes was practically fitted out to depart for her destination and provisions were taken the evening before her sinking. Whilst there is no obligation for the master to sleep on board of his vessel, it is imperative for him to have a guardian watchman, a responsible man, in charge during his absence. Failing this, it was his bounden duty to have been on board the night of the 27th. This obligation on him was all the stronger as the fires were lighted and provisions had been taken in. Whilst fires were lighted there should have been a fireman on duty all night, apart from a deck guardian to attend ropes as the tides rose and fell. There were two men on board and a woman; they were sound asleep and had to be called repeatedly and reached the wharf only a very short interval before the vessel disappeared beneath the water. It is evident they cannot be considered as having been guardians or watchman. The master had not issued any instructions and led his superiors to believe that he was to be on board that very night.

The court found that excessive list caused the vessel to catch under the pier timbers, found the master, Eugene Fortin, in default for gross negligence in the supervision of the property entrusted to his care and suspended his certificate No. 4195 for a period of six months from the 31st of October, 1917, to 30th April, 1918.

"TUNISIE"-"CABOTIA" COLLISION

THE collision between the S.S. Tunisie, a Belgian relief ship, and the S.S. Cabotia, of the Canada Shipping Co., in the harbor of Montreal, October 28, was the subject of an investigation held in the Wreck Commissioner's Court, Montreal, by Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Capts. Francis Nash and Chas. Lapierre as nautical assessors. Hon. A. W. Atwater, K.C., and E. Fabr Surveyor, K.C., represented the owners and captain of the Tunisie, and A. R. Holden, K.C., appeared on behalf of the owners and captain of the Cabotia.

"Tunisie" Master's Evidence

Capt. Joseph Gillies, of the Tunisie, sworn, deposed that he held a Belgian certificate; that his vessel was 1,511 tons register and 2,740 tons gross, of steel construction, having a speed of 9 knots, carrying a crew of 29, including three deck officers and four engineers, with engines of the quadruple expansion type, single screw. The vessel was bound via Halifax to Rotterdam. On the morning of October 28th orders had been given to be in readiness, with pilot on board, for departure; the first and second officers were at their post, and an apprentice pilot at the wheel, the third officer being on the bridge with him. The lines were cast off, and while this was being done two three-blast signals were given, with a few turns of the screw astern to take the stern of the ship away from the wharf. With one tug forward and one aft the vessel was hauled astern slowly, the engines not being used excepting upon leaving the wharf.

Collision Circumstances

A vessel was seen lying idle, but when the Tunisie was half-way between the berth she left the end of the wharf or pier. He noticed the ship start to come ahead and another three-blast signal was sounded. He then noticed the Cabotia backing off; but again she was seen to come ahead full speed, and another three-blast signal was given when a collision seemed inevitable. He noticed the Cabotia going astern on her engines; no signals whatever were given by the other ship. A strong south-westerly breeze was blowing at the time, and the Cabotia was trying to get into Windmill Point Basin. When he saw a collision was to happen he ordered his engines full speed ahead to minimize the impact. The Cabotia struck him fairly astern with her stem, but the damage is very slight.

After the collision he ordered his ship to be moored at Windmill Point Pier.

He further averred that when the collision took place his vessel had no sternway on; but was not certain whether she had any headway.

The master's evidence was corroborated and supplemented by the first, second and third officers and first engineer of the Tunisie.

"Cabotia" Master's Evidence

At a resumed meeting of the Court on November 2 the Court examined Robert Laing, master of the Cabotia, who deposed that he was 35 years of age, had been master for five years, holding a certificate for a passenger steamer in the coasting trade; has been master of the Cabotia since April; she is of wooden construction, 1,530 tons gross and 931 tons net, carrying a crew of 18, including one deck officer and two licensed engineers, with compound engines; speed 8 to 8½ miles loaded, about 9 miles light, single screw, drawing usual canal draft. He did not know if the harbor authorities were notified of his arrival and the berth he was to take. The wind was fresh. He saw the Tunisie coming out of Windmill Basin, she being in full view. He never heard any signals up to a certain time when she was well out of the basin and was bound to collide with him before any signals were given; but when the signal was given she was well inside the end of the slip.

He heard two whistles; when the second whistle was given the Tunisie was almost clear of the pier. At the time he was near the end of the pier, approximately 150 feet feet off. There were two barges tied to the end of the pier. He acknowledges that the wind would have an effect on his vessel. He backed and filled. He had not heard any signals or whistles the last time when he went ahead with the helm hard aport. He did not give any signal though he saw that the Tunisie was going out, the stern a little to the east, and afterwards the stern tug came over to her starboard quarter, the Tunisie being then inside of the Windmill Point Pier. Upon seeing the tug changing position he immediately ordered full speed astern, and was going full speed astern with engines when the collision occurred; but the ship was at a dead stop or possibly with some weigh astern. He thought that at the time the Tunisie was being towed astern at the rate of three miles an hour.

The first officer and chief engineer of the Cabotia were also examined in addition to other witnesses.

Finding

The court considered that the Tunisie had complied with the regulations and customs governing the port of Montreal.

The Tunisie saw the vessel on her port quarter in the centre of the basin, and noticed that she was backing and filling. This is admitted by the master of the Cabotia. In view of such action it was natural for the Tunisie to infer that the Cabotia would not place herself as an obstacle in her path. Moreover, there was no signal of any sort heard from the Cabotia; but when about 100 feet distant from each other the master of the Tunisie, apprehending that the vessel astern was to collide with him, immediately gave an order to the engine room to go ahead to avoid or minimize the seriousness of the impact. By this action the meaning of Article 27 was applied, and with reason.

Article 27 has been violated by the Cabotia. No vessel under any circumstances is to neglect proper precautions demanded by the special circumstance of the case.

The master was alone in the wheelhouse performing the duties of wheelman, look out, and attending to the telegraph, as well as sounding warning whistles, if necessary. Whilst this may be thought permissible by a master when no obstacle is in the way, and no traffic exists, no justification can be found for same in this case, on account of the wind and limited space requiring greater precaution. Therefore the master should have had some one near him to attend to necessary details.

The Cabotia violated also the by-laws of the port of Montreal, in obstructing, impending or injuring the navigation in any manner, and in view of the above the master Robert Laing is found in default, and his Certificate No. 8041 suspended for a period of six months from November 10, 1917, to May 10, 1918.

"SCANDINAVIAN" STRIKING

IN the Wreck Commissioner's Court, Montreal, before Capt. L. A. Demers, Dominion Wreck Commissioner, assisted by Capts, Francis Nash and Chas. Lapierre, acting as nautical assessors, an investigation was held into the causes which led to the hull of the SS. Scandinavian being damaged whilst in the River St. Lawrence between buoys 90Q and 92Q on Nov. 17, proceeding to Montreal in charge of a pilot. A. R. Wolden, K.C., appeared on behalf of the owners of the Scandinavian, while R. T. Heneker, K.C., looked after the interests of the Master on behalf of the Imperial Merchants' Service Guild.

Master's Evidence

Capt. John Murdock Reith, of the Scandinavian, stated that the vessel's official number was 109,441, that she was of 12,100 tons gross, 7,729 tons net, being steel built, with twin screws, carrying a crew of 240, including five certificated deck officers and eight engineers, owned by the Canadian Pacific Ocean Services; that she was drawing 18 feet 8 inches forward and 24 feet 10 inches aft, leaving Quebec, she was 568 feet long, 59 foot beam, with a speed of 15½ knots. He deposed that she left Quebec at 7.55 p.m., weather clear, but overcast, very little wind, the full speed of 15 knots being maintained. He had been on the bridge off and on, and about 11.18 p.m., while on the lower bridge a shock was felt, and he proceeded to the navigating bridge and inquired of the pilot the cause of the shock, looking aft at the same time and noticing that the Grondines Lights were in line, showing they were in mid-channel. The ship's speed was diminished and soundings taken, indicating No. 6 tank making water. Full speed was resumed, and after arriving at Montreal the vessel was placed in dock, when it was seen that the object struck had dented B plate somewhat abaft the bridge, making a clear cut on that plate right aft, and it was also found that one blade of the starboard propeller was broken. There were two lookouts in the crow's nest, and two officers on duty on the bridge besides himself and the pilot who was steering, the quartermaster standing by.

Pilot's Evidence

Pilot Napoleon Lachance was next examined, he stating that he held a branch pilot's license for nine years, during which time he had one accident; that he was at the wheel when the ship touched, steering on the ordinary lights and ranges. He saw buoys 90 Q and 92 Q. The ship was going full speed, when all at once, between 90 Q and 92 Q she struck something, and he immediately stepped aside and saw the Grondines Lights were in line. The turn had been made and he had gradually steadied the wheel. He had to let go of the wheel in order to see the lights astern of him on account of the funnel which obstructed his view directly abaft the wheel. He assumed the ship struck a boulder, and was positive that he was in mid-channel.

Other witnesses were examined including Mr. Forneret, superintending engineer of the ship channel and Fred A. Wise, engineer in charge, who related his operations in connection with sweeping the channel after the accident.

Finding

In the point of view of the Court the damage to the propeller would have an important bearing in arriving at a solution of this unusual casualty, if no other evidence were at hand. In the absence of a wreck in that locality, and in view of the frequent passages of vessels of deeper draft all throughout the summer, necessarily in the same course, it does appear strange that at this period of the year an obstacle should be found at or near the spot mentioned in the evidence, that is between the buoys as above mentioned. Had it been in the spring of the year, at the breaking of the season, whilst ice floats down in immense masses, it might be expected that these masses, with the influence of the tide, would dislodge some boulders from the lately dredged banks and carry them bodily onward to dump them later on here and there.

The possibility of this was granted, and if boulders are found they are picked up by the Department of Marine's sweepers, under the guidance and superintendence of the ship channel staff, and a report,—the Court assumes,—is forthwith sent out that the channel is clear, ensuring safe navigation.

In no manner of means, however, could the Court conceive that a boulder or

pinnacle of rock did the damage to the Scandinavian's starboard B plate.

It is elementary for the shipping men, owners, agents, as well as underwriters, to surmise and trust that all throughout the season up to the time the last ship has left the St. Lawrence, immediate help is at hand in whatsoever nature or kind, and it develops that the attempt to assure an anxious public that the channel was clear or not clear of obstacles was not conclusive. As evidence of real effective effort to sweep the channel from bank to bank, would have gone far towards helping the Court in arriving at a solution in this case, and affect the evil consequences of a report to Lloyd's and broadcast to the effect that a boulder was struck in the ship channel, late in the season—practically at the close of navigation, whilst a dozen ships had still to pass through that channel.

The Court could not arrive at any other conclusion than to accept the preponderance of testimony from the Scandinavian, and exonerate the pilot, master and officers of all blame, and to add that the nature of the obstacle which caused the damage has not been revealed or ascertained.

CANADIAN VICKERS LAUNCH BIG FREIGHTER

ON November 29 Canadian Vickers launched from their shipyard at Maisonneuve, Montreal, the Norwegian freighter Porsanger, whose classification is 100A1 at Lloyd's and Det Norske Veritas. Mrs. W. H. Lynch, wife of the managing director of the builders' establishment, performed the christening ceremony. Leading particulars of the vessel follow:

Length over all, 394 ft. 6 in.; between perpendiculars, 380 ft.; beam moulded, 49 ft. 3 in.; depth moulded, 30 ft.; deadweight, 7,000 tons; gross tonnage, 4,670 tons; load draught, 24 ft.; water ballast capacity, 1,630 tons. A double bottom runs throughout the length of the ship between fore and aft peak bulkheads, and the hull sub-division arrangement gives a total of fourteen watertight compartments. Two steel masts are fitted, the tops being telescopic for navigating the Manchester Ship Canal. Cargo handling and other deck equipment consists of eleven steam winches serving five large cargo hatches, steam windlass, steam and hand-steering gear, etc. The Porsanger is expected to make not less than 9 knots when fully laden. Electric lighting is installed throughout the ship, and steam heating features the crew accommodation.

The main propelling engines are of the triple expansion type, the cylinders being 25 in.-41 in.-67 in. in diameter by 45 in. stroke. They are capable of developing about 1,750 indicated horsepower. The h.p. cylinder is fitted with a hard cast iron liner. The pistons are of cast iron box section and well ribbed. The intermediate and high pressure pistons have Ramsbottom rings, while the low pressure piston is fitted with Lockwood patent rings. A piston valve serves the h.p. cylinder, and double-ported slide valves the i.p. and l.p. Piston, connecting, valve, and eccentric rods are of forged steel. Steam-operated reversing gear of the all-round type is fitted. The crank shaft of forged steel in three interchangeable pieces is carried in six white metal-lined main bearings. The thrust block is of horseshoe pattern and the propeller of cast iron. Thrust, tunnel, and propeller shafting is of forged steel, with solid collars and couplings.

The condenser of circular type is supported on the back columns of the main engines. It is body built of steel plate, and contains 2,200 sq. ft. of cooling surface. The air and circulating pumps are single and double acting respectively, being, together with the main feed and bilge pumps, operated through levers from the L.P. crosshead.

Two multitubular marine type, single-ended, three furnace boilers are installed, each being 16 ft. in diameter by 11 ft. 3 in. long, and giving a heating surface of 5,200 sq. ft. and a grate area of 138 sq. ft. Natural draft only will be employed.

Guests at Launch

Amongst those present on the launching platform were Mr. and Mrs. W. H. Lynch, Consul-General Aubert, Mr. and Mrs. W. G. Ross, C. H. Cahan, K.C.; J. T. Bethune, Senator Smeaton White, J. G. Lewis, Mr. and Mrs. W. J. Lewis, Mr. and Mrs. F. W. Cowie, M. P. Fennell, Capt. Bourassa, Mrs. Girard and Miss Bourassa, Charles Robilliard, Mr. and Mrs. F. H. Markey, Judge Saint-Cyr, Mr. and Mrs. Miller, Mr. and Mrs. H. Driver, W. H. Henderson, H. Williams and daughter, Rev. R. L. Ballantyne, Capt Walsh, B. B. Stevenson, Capt. Landriault, Governor of Bordeaux Jail; Hans Johansen, R. Smith, of the U. S. Shipping Board; Mrs. T. McL. Hutchison, Mr. and Mrs. W. J. Alderson, Mr. and Mrs. H. M. Cameron, Jas. Carruthers, Mr. and Mrs. Macintosh, J. H. Rodgers, etc.

SILVER WAR BADGE FOR MERCANTILE MARINE

THE Marine Department of the Board of Trade recently issued the following memorandum.

1. These conditions will govern the grant of the Silver War Badge to those eligible among masters, officers, and seamen of British merchant ships (whether on Government service or not) in which the wages are paid by the owners.

2.—The Silver Badge may be awarded by the Board of Trade to any master, officer, or seaman coming within the definition in paragraph (1) who is incapacitated for service in the Mercantile Marine through—

(a)—an injury resulting from any act of hostility by or against the King's enemies;

or (b)—Illness or shock due to being torpedoed or under attack;

or (c)—"Strain" due to war conditions, including cases in which the nervous, mental, or physical strain of service at sea under war conditions has made the man unfit for further service at sea;

or (d)—Some disease e.g., malaria or dysentery) resulting from employment on a ship on Government service in an unhealthy climate.

3.—The badge may be granted if it is proved that a man has been unable to go to sea for at least six months, and if the Board of Trade are of opinion that it is unlikely that he can go to sea within the duration of the war.

4.—The award of badges to naval ratings, or to masters, officers, or seamen of the Mercantile Marine, who are serving under special naval engagements in his Majesty's ships, and auxiliaries, and whose wages are paid directly by the Admiralty, or Ministry of Shipping, will rest with the Admiralty.

5.—The War Risks Associations who administer, on behalf of the Board of Trade, the Government War Risks Compensation Scheme, will forward to the Board of Trade in the prescribed form full particulars of any case in which they are of opinion that the conditions of paragraphs (1), (2), and (3) are complied with, and will recommend the grant of the badge in such case.

6. The final decision in each case will rest with the Board of Trade.

ELECTRICALLY-CONTROLLED MOTOR BOATS

THE British Admiralty recently made the following statement on the subject of electrically-controlled motor boats:

The electrically-controlled motor boats used on the Belgian coast are twin petrol engined vessels partially closed in, and travel at a high speed. They carry a drum with between 30 and 50 miles of insulated single core cable, through which the boat is controlled electrically. The forepart carries a considerable charge of high explosive, probably from 300 lb. to 500 lb. in weight. The method of operating is to start the engine, after which the crew leave the boat.

A seaplane, protected by a strong fighting patrol, then accompanies the vessel at a distance of three to five miles, and signals to the shore operator the helm to give the vessel. These signals need only be "starboard," "port," or "steady." The boat is zig-zagged while running; this may be either intentional or unintentional. On being steered into a ship the charge is exploded automatically.

The device is a very old one. A boat similarly controlled was used in H.M.S. Vernon—the torpedo experimental ship —as far back as 1885. The only new features in the German boats are petrol engines and W.T. signals, neither of which existed then.

On November 3 the Admiralty announced that on the same day an attack by an electrically-controlled high speed boat was defeated and the boat destroyed. It was then pointed out that electrically-controlled craft, whether surface boats or torpedoes, were no novelty, and that in trials made in Stokes Bay in 1892 with an electrically-controlled torpedo the length of wire cable used was about 4,500 yards.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

THE UNEXPECTED VOYAGE—A CHRISTMAS YARN

By Capt. Geo. S. Laing

"We are really off, dear, see the great steamer forge ahead, isn't this superb?" So spoke Frances Gordon, a bride of four hours, to her joyous husband, Archibald Gordon, as the S.S. Panama left the dock at St. John, New Brunswick, bound for the great water ribbon that separates the two Americas. The couple who were now in that stage of human companionship that is fathomless in capacity, were just tingling with the rapid fire of events that had suddenly made them one. The mirror that reflected the escapade of Frances and Archie had a most unusual setting. While they pace the promenade deck almost intoxicated with the moving panorama of scenery and mutual bliss, let us peep behind the screen of time.

Back in Moncton, Frances and Archie had played with each other as children and while Archie had for the last five years held a good position in a fish company in St. John, he had never lost for a moment the indelible remembrances and affections encircling his boyhood days. It would seem, however, that some men cannot fall in love by the usual demonstrative way, but a soul worship of reciprocal affinity seems to burn in a taken-for-granted manner between the parties concerned.

Each annual vacation took Archie Gordon to Moncton, and on these occasions he was received into the bosom of the Duncan family, where of course Frances was the central gem. Still they were not engaged to each other in the orthodox way and this was the hinge that almost swung the door of opportunity in Archie's face for ever.

Mr. and Mrs. Duncan were getting old and Frances must be comfortably married before they slipped away. Some lovers had almost literally knelt at her feet, others had emphasized their adoration in more decorous attitudes, whilst all but one late-comer had been given the cold and shivery ultimatum that was spoken in such angelic and tear-faced earnestness, that no real gentleman could ever present himself a second time on such an important errand.

The latest man to be blown into the social whirlpool of Moncton was no other than Dan F. Stone, Jr., son and heir of "old Stone" the lumber magnate. At two or three of the winter functions it was easily noticed that Dan of the wood pile was ready at any moment to be charmed into the halo that Cupid constantly held over the heart of Frances Duncan. And why not? dark eyes with flash-light sparkles, auburn tresses, cheeks that were polished with the elixir of out-door sports and youth, a form that would magnetize the sculptor or painter, and above all, an unaffected disposition that would make any man stand back and admit inwardly that such a woman was the embodiment of sincerity, purity, and charitableness—has such a one to go begging?

Opportune moments in love's affairs come at the command of the chivalrous, and young Dan Stone has offered himself (in addition of course to his prospects). True, no words escaped the lips of Frances Duncan this time, neither a yea or a nay. But it appears that at such high tension ceremonies, silence has often been taken for consent, Dan took it that way, poor chap, and before retiring that same night he had broken the news by mail to his parents, admitting he was in the strong meshes of human partnership and would go further by asking old Mr. Duncan for the hand of his daughter in matrimony, the earlier supposed acceptance being of course informal.

Here was a terrible dilemma. Frances realised when she was alone in her room that this man had to a certain extent a right to come back and pay added homage at her shrine of maiden attraction.

Why had she altered her style of refusal?

Why had she been speechless before the latest admirer?

The name of Archie Gordon and the most minute details of his features in flesh and character would not allow her to sleep on this peculiar night.

Next morning before her parents were astir she was at the telegraph office paying for the following despatch to Archie in St. John:—"Must see you before changing name of firm, suggest that I come to St. John to-day, please advise."

As Gordon put this business-worded but most astounding telegram back in its official envelope, his lady secretary guessed by his erratic behaviour that a bereavement had occurred in his family. Touching the button for the office-boy, he wrote out in heavy type and with a noticeable tremor his answer to Frances: "Imperative, come, wire again on train."

Frances who had often travelled alone had no trouble in getting her parents consent for the holiday, and when she mentioned whom she was going to meet, all was serene. Archie was beside himself with excitement, rage, and mixed ideals. He had really woken up and interpreted the message. To think that some other fellow should snatch his child-love up and show her a rose-strewn path to palatial bliss was the last straw that certainly broke down this quite common type of wooer.

The train is on time, they have met, but so far the meeting is more funereal than joyful. Frances is saying through the silvery petals that come alike in great grief or exuberant joy: "Really, Archie, this is no intrigue, surely you understand—where are we going?"

"We are to stay overnight at my partner's home, his wife has kindly extended the invitation. I am frequently at their home and in my feverish wait for your safe arrival I confided our affairs. And further, if you are willing we can be married to-morrow at noon and sail on the S.S. Panama four hours later on our honeymoon to the South." All this was far too much for poor Frances who had inwardly worshipped this man from boyhood, and yet had extracted very little of the subtle harmony that accompanies most folks on their voyage through courtship.

On arrival at their temporary abode every imaginable obstacle was removed to make the lovers at ease in their stormy predicament, and graceful tactics with genteel diplomacy made the lady of the house exceedingly sympathetic for Frances, while the two men talked over some business affairs that Archie had left in a muddle at the office, and wound up by nearly shaking each other's hands off over the unexpected voyage.

After a meal at which very little was eaten, Frances and Archie were left alone in the drawing room to muse on and prearrange to-morrow's doings. For fear a wire would hurt the old Duncans, a letter was sent at once with full explanations and a likely course of their actions as regards a home after the return from the sea voyage honeymoon.

The gestures of Archie Gordon, when he heard from his bethrothed lover's lips the several stories concerning would-be husbands, could never be fully portrayed by pen or brush. And when it came to the one, Dan F. Stone, Jr., who so nearly wrecked Archie's dream, the uppermost thoughts of our careless wooer had motor cars and revolvers in their setting.

"What did you say to this man Stone, dear, when he proposed?"

"I didn't say anything Archie."

"Then you have no proposition to unravel?"

"None whatever, he will read of our marriage in the Moncton press, you will handle that won't you?"

"Why most decidedly."

After a few hours' rest the morning broke into a glorious day. The snow that had come to herald the Christmas season used its most cute artistic touches to adorn St. John in its winter splendor. To the young couple, at least, everything seemed to hum with satisfaction. The time before noon was made the most of in purchasing a suitable trousseau, compatible with the hurried marriage and almost immediate embarkation. Archie had not yet got over the progress of his life's developments in the last twenty-four hours, and he almost

clutches at his bride-to-be for fear some unseen monster should lower a fairy hand from the sky and lift his prize away into space.

With such a short time for preparation, it was a gracefully sweet and smart bride that stood in the study of the Rev. J. E. Stinson at 2 p.m. sharp, with her husband on her right hand and the world before them both.

The Moncton papers had the news by telegraph about the time that Mr. and Mrs. Duncan read with parental joy of the unexpected but happy affair from a note in which both had contributed a little. No one was nonplussed except the innocent instigator of the whole affair, to wit, Dan. F. Stone, Jr. But Dan is still very young and of a plastic nature, his bump will heal and he may get others before he settles down. The chaff from "the boys" worried him far more concerning the estrangement than the darts from Cupid's quiver that had to be retracted.

After a most enjoyable trip to Colon, for both Frances and her husband made good sailors, the voyage was continued to Santa Cruz, California. At this lovely spot the couple spent the remainder of their honeymoon and laughed and giggled over the dark clouds that almost engulfed them and might easily have caused their separation.

A year has gone and every day in it has woven a stronger and truer love around the hearts and lives of the Gordons. Archie often upbraids himself for not recognising the magnitude of the gem that awaited his command or request, and when he ventures to think that he might easily have lost her, his gratitude becomes almost pitiable.

When the wee stranger comes, he or she is to have a name resonant of the wild ocean that bore the parents away on their unexpected honeymoon and brought them safely back to the land of their happy home—Canada.

VELOCITY OF SOUND IN SEA-WATER

By T. J.

AS is well known, the aberration to which aerial sound signals are subject makes the transmission of sound through water a much more desirable medium for the exchange of signals, but there is a certain amount of error always found in short distances from the shore when a ship is endeavoring to find her distance by echo. The elasticity of the water is a great determining factor, as the velocity of sound through a medium is equal to the square root of the quotient found by dividing the elasticity of the medium by its density. The elasticity of sea water is 2.02 by 10.10, and its usual density is 1.03; and the computed velocity of sound through the ocean is therefore 1,400 metres, or 4.593 feet per second. Owing to the uncertainty of locating the place from which the sound waves are reflected to form an echo any method of finding distances in navigation by means of submarine echoes is not at all serviceable. In the location of sound signals every effort is made to avoid the formation of echoes on account of the uncertainty which their presence produces in locating the submarine signal.

ELECTRIC DRIVE FOR WARSHIPS

By D. Street.

IT is confidently expected by those who favor electric transmission for ship propulsion that the electrically-driven cruisers and battleships now building for the American Navy will demonstrate conclusively that the electric drive is superior to all others for naval vessels of this class. The features upon which this confidence is mainly founded are the maintenance of a high efficiency at all speeds, and the diminished risk of a vessel being temporarily crippled by a breakdown in the engine room.

The Efficiency Feature

No attempt is made to claim for electrical transmission as high an efficiency at full power and speed as can be obtained from the geared drive. In the new battle cruisers the losses from turbine to propeller shaft will be about 7 per cent. at top speed. It is conceded that at full speed a geared drive will show a better figure than this—better, perhaps, by 2 per cent.—but a battleship is only on full speed for a fraction of its time, and the normal cruising speed requires only about one-tenth of full power. It is here that the electric drive is expected to show great advantages. At light loads the efficiency of the geared turbine equipment falls off considerably owing to the reduced thermal efficiency of the main turbines themselves, and to the relatively greater drag of gearing, bearings, reversing turbines, and idle parts of the main turbines.

Even though special cruising turbines are fitted, the efficiency at cruising speed must be low, for such turbines cannot have the efficiency of a single large main turbine, and they add still more to the drag. With the electric drive the transmission efficiency can, on the other hand, be kept equally good at all speeds; the number of motors and turbines used can be adapted to the demand for power, and this gives a very important gain in economy at all speeds below the maximum. At 19 knots only one turbine is required to drive the ship, and it runs at full speed instead of at half-speed as it would in a geared equipment. Thus the steam efficiency at 19 knots—a desirable cruising speed—is equal to the best attainable at any speed, and as cruising economy gives increased cruising radius without renewal of fuel supplies, high efficiency at this speed is a matter of the greatest importance.

Breakdown Possibilities

In regard to the risks of complete breakdown, it is pointed out that in the geared equipment each shaft has a system of turbines, gears, bearings, thrust-balancing devices, and lubricating systems, all mechanically locked together, and that with high speed machinery any kind of trouble with any of these parts generally necessitates the immediate stoppage of the whole system, whilst if a breakdown has occurred it may be necessary to stop the ship while the wreckage is cleared away and the shaft uncoupled, after which the idle propeller would still act as a very serious drag on a fast vessel. In the electrically-driven ship there is no mechanical connection of the shaft to anything but the rotors of the motors, which cannot be subject to mechanical interference.

The shafts are subject to the same possibilities of bearing or thrust trouble as shafts in other ships, but the presence of the motors does not increase this danger, and the speed being low, it is remote in any case. With this equipment any motor, generator, or turbine, if in any kind of trouble, can be instantly disconnected without stopping the ship and with only a small loss from the highest speed capacity. The versatility of transmission constitutes one of the most important advantages of electric drive in such a ship. With one motor out of eight in trouble only one-eighth of the maximum capacity is lost, and the ship's maximum speed is impaired by only about one knot. If a generator or turbine is in trouble the maximum speed is reduced only about two knots. With two generating units and four motors out, the ship can make 26 knots, and with three generators and four motors out she can make 19 knots. If parts give trouble they are simply cut out and repaired at leisure, or as opportunity affords.

Self-Contained Reverse

A further point made is that the electric drive dispenses with the need for reversing turbines and eliminates complications which they involve. Importance is also attached to the large gains in fuel economy afforded by super-heat, and it is expected that the demonstration of the ability to use safely high degrees of super-heat may constitute one of the most important reasons for adopting the electric drive. In opposition to these claims can only be advanced one, that of greater weight. This can be discounted on the heavy ships, where protection is of vital importance. On the light fast vessels, such as destroyers and scouts, where no protection exists, everything is sacrificed for speed, and for such vessels the mechanical reduction gear stands pre-eminent to-day.

Important Shipping Transfer.—Announcement was made on December 17 that the business of the Frontier Trading Co., of Ogdensburg, and the Canada Shipping Co., of Montreal, had been taken over by the George Hall Coal & Transportation Co. of Ogdensburg. The deal gives the Hall Co. an extra fleet of sixteen vessels with an aggregate tonnage of 20,000. The vessels will be placed in the coal and wood pulp trade between ports on Lake Ontario and the St. Lawrence River. Four vessels owned by the Hall Co. were commandeered recently by the United States Government.

Steam Saving Auxiliaries of the Engine and Boiler Rooms

By C. T. R.

In view of the circumstance that steam-saving auxiliaries aboard ship continue to increase in number, and that they are being designed and constructed to meet, in the most effective manner, both ordinary and special service applications, this series of articles describing and illustrating at least the more important types of such apparatus seems to us more or less timely, both from the point of view of familiarizing engine and boiler room staffs with the products of different manufacturers, and that of their acquiring a closer intimacy with specific detail arrangement, relative to operation, maintenance and periodic overhaul.

BOILER-FEED REGULATORS—I

PERHAPS no feature of power plant operation has been rendered more vital by reason of modern developments than that of maintaining a correct water level in steam boilers. Particularly where water tube boilers are in use,

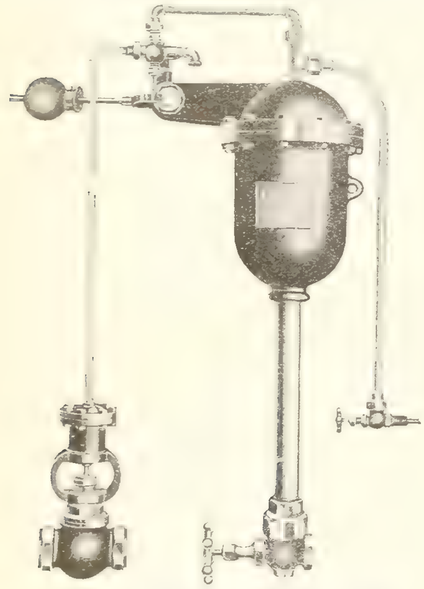


FIG. 1. "VIGILANT" FEED-WATER REGULATOR.

containing a minimum amount of water per square foot of heating surface combined with high rates of evaporation, the necessity of adopting some mechanical device to eliminate the uncertainty of human control becomes more and more evident. In common with other apparatus which has been developed with the object of eliminating the human element, the automatic boiler feed-water regulator, as instanced by the numerous types now in existence, has filled a long felt want successfully, and much of its success has been due to the fact that in addition to fulfilling primary object of it development its adoption has been accompanied by other benefits such as economy of fuel, the generation of uniformly dry steam, increased life for the boilers, and saving of labor. As a safeguard against explosions due to neglect in hand operations, feed-water regulators are indispensable and for this feature alone if for none other, they should form a part of every boiler equipment.

Economy of Fuel

For every type of boiler there is a certain water level generally, but not always at middle gauge which allows the boiler to work with the maximum heating surface and steam space combined with the safe minimum of water. By operating the boiler constantly at this point maximum economy is obtained. However, in some cases where loads are variable and heavy, the capacity of the boiler may be temporarily increased by allowing it to fill up to the highest desirable level before the heavy load comes on, after which, by reducing the rate of feed, the boiler will steam at an increased rate as the pressure drops slightly. The question therefore arises regarding the advisability of operating at a fixed level or at a variable level, and regulators for each system are available.

Dry Steam

Any properly designed boiler when operated at a proper rating with water of average purity should not prime, but if the water level be allowed to rise too much, and an overload occur at an inopportune moment, the boiler may well earn a bad reputation which should instead be borne by the operator. It is safe to say that probably 80 or 90 per cent. of priming trouble is due to careless handling of the water level. The troubles arising therefrom are familiar to most power house operators,—wasted lubrication with consequent scoring of cylinders, water hammer with its disastrous effects when excessive, and loss of economy even when slight,—all the indirect losses due to the presence of these troubles may be avoided by insuring a safe limit to the variation of water level.

Durability

Boilers are generally allowed to run dry only once, the cost of the trouble is a new boiler, but the effect of a widely changing water level, with its variation in temperature, in decreasing the useful life of the boiler is none the less certain though somewhat slower. Few boilers possess such perfect circulation and steaming capacity that water even at 200 deg. Fahr. can be pumped in at a high rate and then allowed to steam at an increasing temperature, which will again be lowered when feeding re-commences. Such treatment may not affect

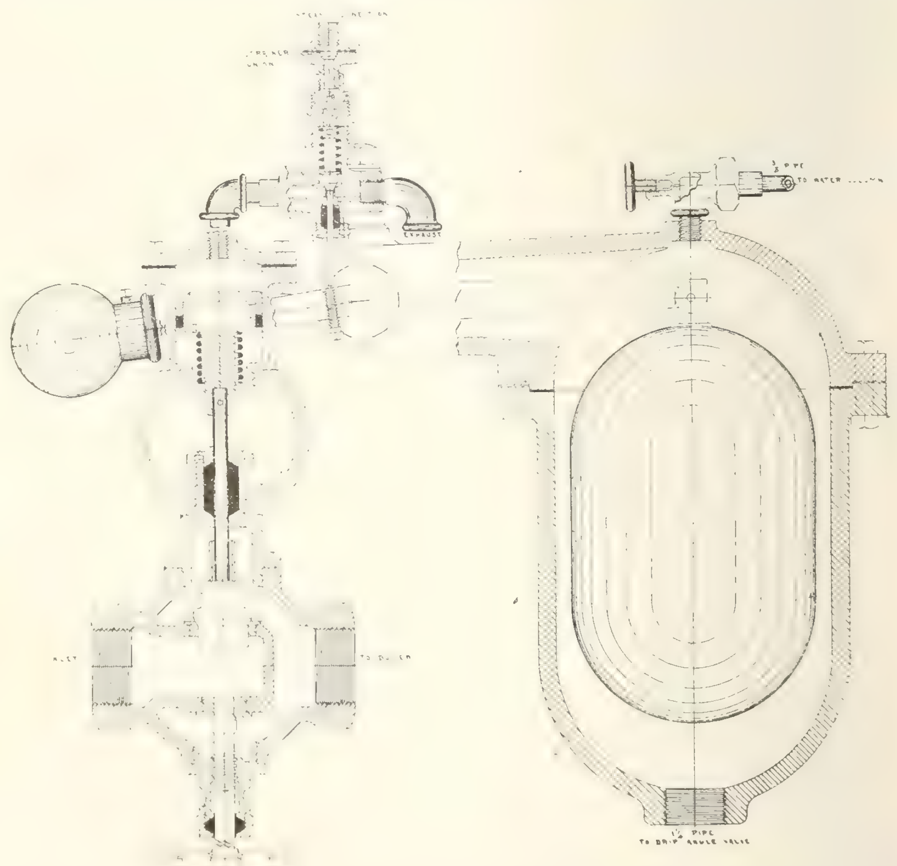


FIG. 2. SECTIONAL VIEW OF "VIGILANT" REGULATOR SHOWING ARRANGEMENT OF OPERATING MECHANISM.

a boiler adversely immediately, but the repair bill will be constant and increasing as the years roll on.

Increased efficiency on the part of the attendant is the natural outcome of the adoption of such devices. Just as surely as the safety valve, the high and low water alarm, the fusible plug and the mechanical stoker have relieved him of the strain resulting from continuous attention to numerous duties any one of which in itself may be of a minor nature but when attended to collectively involve a degree of close application which leaves little opportunity and less desire for performing his duties in a loyal and broad-minded manner.

Classification

Feed-water regulators may be divided roughly into two main types—intermittent and continuous—these again being grouped according to the manner of obtaining the motive power necessary for their operation. All regulators, no matter what type consist of two main units, the primary operating device directly affected by change of water level, and the secondary controlling valve on the feed line which is dependent on the primary for its operation. The primary is generally referred to, as the regulator, and the secondary as the controller. While the first type of feed-water regulator has been referred to as intermittent, the majority of them are not really so in the sense of stopping off the feed completely, but are arranged so that minimum flow of feed-water passes through at all times, adjustable to the requirements of any one boiler. As they do not shut off completely, the use of a high and low water alarm is desirable.

The continuous type of feed-water regulator, on the other hand is always in operation except when there is no load on the boiler resulting in maximum water level which stops the controller completely. As the boiler resumes operation, the regulator opens the controller gradually, the amount increasing as the water level decreases till at full load a maximum amount of feed-water is passing while the water level is at the height best suited for full load operation.

"Vigilant" Regulator

This apparatus is of the intermittent type and is actuated by a solid body inside of a vertical column, the weight of the body being altered as it is alternately submerged by the rise and fall of water in the column. By means of suitable mechanism, the movement of the weight is transmitted to the feed valve with resulting control of the feed-water. An exterior view of the entire apparatus is shown in Fig. 1, and a sectional drawing in Fig. 2.

Referring to Fig. 2, a small angle valve on top of the column is connected to the water gauge column at the height at which it is desired to have water level. The lower end of the column is connected to the water space of the boiler at any convenient point. The displacement weight is suspended from one end of a lever whose fulcrum shaft extends out through a stuffing box and supports another lever with an adjustable counterweight. The counterweight lever has an adjusting screw set to operate a pilot valve located above, which controls the supply of steam to the operating cylinder of the controlling valve on feed pipe.

The controlling valve is similar in construction to a check valve. A stem extends from the valve to a chamber above the cast iron loop, and is connected to a piston moving in the chamber. The upper cover of the chamber forms a reservoir for water which prevents the live steam from coming in contact with the rubber cup and underneath the piston is a spring to assist in opening the valve when there is no pressure on the piston. In the lower part of the valve body is shown a by-pass or continuous feed valve which can be adjusted to suit any desired rate of boiler consumption and thus minimize the operation of the mechanism.

Assuming the device in operation, as the water in gauge column rises past the opening of the connection to regulator chamber, steam is cut off from the chamber and the contained steam then condenses, allowing the chamber to fill with water through the lower connection. The displacement weight now weighs less than it did when not submerged, and is tilted up by the counterbalance weight which allows the small pilot to seat on its lower end, and open the steam admission valve at its upper end.

The steam pressure immediately depresses the piston of controlling valve and shuts off feed. No more water can enter the boiler until the water returns to the level of the gauge connection when steam again enters the chamber and the contained water returns to its own level. The increased weight of the displacement body causes it to descend, raising the counterweight and reversing the position of the pilot valve. The steam which held the control valve is now exhausted through the lower valve seat and relieves the pressure on top of piston, thus allowing control valve to open again.

The foregoing cycle of operations are repeated as the water gets above or below the desired point, with a variation not exceeding one-half inch. The operation of the device is indicated by the counter-balance weight which is up when feeding and down when shut. This regulator is the product of Chaplin—Fulton Mfg. Co., Pittsburgh.

ELECTRICALLY-CONTROLLED BOATS

A FURTHER official statement, issued on November 12, with regard to the electrically-controlled motor boats used by the Germans on the Belgian coast, disposes of the theory that this device is a practical adaptation of the radio-control system which many inventors, notably Tesla, Orling and Hammond, have attempted to perfect. On the contrary, says "The Engineer," the German weapon is very simple and has no claim to novelty.

The German boat, which is probably built on hydroplane lines in order to attain the highest possible speed, must be of considerable size, since it is equipped with powerful twin petrol motors and carriers, in addition to an explosive charge of 300 lb. to 500 lb., a drum containing from 30 to 50 miles of insulated cable. The only original feature is the aerial escort, which keeps both the motor boat and the target under observation and signals back to the controlling station the degree of helm required to bring the boat into contact with the objective. Provided that a boat of adequate size were used, there seems to be no reason why the range should not be greatly extended, though in deep water the drag of the cable would probably diminish the speed. It is a weapon that might prove a valuable adjunct to coast defence, while, if the controlling station were on board a ship, boats of this description could doubtless be used to attack enemy vessels lying in a harbor inaccessible to submarines or ordinary torpedo craft.

An early example of this system was the Lay torpedo, which was tested at Newport, U.S.A., in 1879. It consisted of a cigar-shaped steel vessel, 28 ft. long, and divided into four compartments, the motive power being ammoniacal gas, generated by pouring ammonia on a carbonate. The gas had a pressure of 40 atmospheres and was led through iron pipes to an engine in the rear compartment. In the third compartment was a reel of ten miles of insulated wire, connected with the firing station. The position of the torpedo was shown by guide poles projecting several feet above the water. The torpedo was capable of travelling at about 11 knots, and was almost wholly submerged. The first compartment held a charge of 300 lb. of powder, or 75 lb. of dynamite. It was a very complicated weapon, easily liable to derangement, and although many of these torpedoes were supplied to foreign Governments, they were soon superseded by the Whitehead.

IN THE SHIP'S ENGINE ROOM

"The chief engineer, a Scot. . . " Certainly and always! Passenger ship, freighter, yacht, from here to Suez and back again, the man in charge of the engine room probably is a Scot, says the "New York Sun." There is no special reason for it; it just happens that way. There is the old story, told with zest to-day by travellers who will swear that they witnessed the doings of an American and an Englishman who beguiled the time in Shanghai by wagering substantial sums on their odd achievements of knowledge. The Englishman, of course, was behind in the game, but finally he hit upon a brilliant wager; he bet that every ship making ready to sail that day carried a Scot in the engine room. So to every engine room door they went and called "Sandy," "Mac." And every engine room gave its reply. The story must be as old as the steam engine. The bet could be won to-day. "The chief engineer, a Scot."

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Vol. VII DECEMBER, 1917 No. 12

PRINCIPAL CONTENTS

THE SEASON'S GREETINGS

TO the subscribers to and advertisers in MARINE ENGINEERING OF CANADA we, as its publishers, extend heartiest Christmas Greetings, and express the hope that the New Year on which we are about to enter may not only bring "Grist to the Mill" as has its immediate predecessor, but usher in that era of peace and goodwill overdue, yet so much desired, in both a national and international relationship sense.

WHAT HAS THE YEAR BROUGHT?

THE approaching close of the year bids many of us glance backward and in silent retrospect consider whence we have come and whither do we go. Each year has seen the prediction that the war would soon be over, and each year still sees it with us, influencing our thoughts, words and deeds to such an extent that, when it does reach a conclusion, the void left by the disappearance of such a mainspring of industrial activity will be immediately unfathomable.

Military events have influenced activities of the past year very greatly, for instance, the alternate depression and cheerfulness which have marked the fluctuations in munitions manufacture. That such happenings should take place is incidental to the nature of their origin, but that their effect on our private and national disposition should pass unnoticed is not right. It must be constantly kept in mind that the readjustments necessary during the transition period will have a much more acute influence on our individual lives than any temporary depression has had hitherto.

As a nation, Canadians in Canada have suffered less than any other. That we can expect to see the business through and remain on Easy Street while the rest of the world is struggling in by-ways and vacant lots is absolutely foolish. Knowledge to plan, ability to execute and determination to support our share of the world's burden, willingly as well as uncomplainingly, are the essentials for our future guidance. It is a pleasing feature of the situation that financial interests realize the extent to which ability to withstand it will determine more than anything else its duration and intensity.

The time for preparation is here—preparation for any eventuality, and the tentative evidences during the past year of all that readjustment will imply must receive more than ordinary consideration from those directly concerned with the industrial future of the country. If the year has done nothing else than bring to us all a sterner realization of the present and determination to face the future, it has not been unavailing.

SHIPBUILDING ACTIVITIES INADEQUATE TO THE EMERGENCY

A DISPATCH from Washington, D.C., covering the first annual report of the United States Federal Shipping Board, indicates that the present powers of the latter are totally inadequate to meet the existing ocean freight service emergency arising from German submarine activity. Additional powers, it is claimed, are necessary, so that control may be had of ocean freight rates, and the regulation and supervision of shipping generally. The Board declares that not the least of the problems confronting it is the threefold one of getting, keeping and training men for their respective tasks and duties.

Vessel tonnage of mammoth quantity is under construction and on order on or near every waterway, lake and ocean coast of the United States and Canada, yet there is little doubt that the work as a whole is not marked by that progress which is so desirable, because so urgent. The frank statement by the Shipping Board of its inability to cope with the situation without extended powers is in no sense a confession of weakness, rather is it a warning, originating from expert conviction to those whom it serves, that measures more drastic be enacted and become operative without delay.

CANADIAN MARINE "HEADLIGHTS"

JOHN JOSEPH COUGHLAN, active managing partner of the firm of J. Coughlan & Sons, structural steel and ship builders, Vancouver, British Columbia, was born at Victoria, B.C., October 3, 1880, the son of John and Margaret Coughlan. He was educated in the public and high schools of Victoria, also at St. Louis College, New Westminster, B.C., becoming later a member of the original firm of Coughlan & Co., which after an extended period of

JOHN JOSEPH COUGHLAN.

successful effort (1902-07) was absorbed in the latter year by a new organization since known as J. Coughlan & Sons.

Mr. Coughlan married Susie A. Cameron, of Exeter, New Hampshire, in 1900, the family consisting of one son and one daughter.

His recreations are boating, fishing and hunting. In matters of religion he is a Roman Catholic. The family residence is at Kitsilano, B.C.

The firm of J. Coughlan & Sons in the sphere of structural steel engineering have to their credit such important buildings as the Vancouver Hotel, C.P.R. Station, Standard Bank Building, Metropolitan Building, World Building, etc., in Vancouver, while in other districts of the province, public buildings, railroad and highway bridges give expression to their manufacturing achievement.

Munitions making featured the firm's activities for several months following the outbreak of war, but this has now given place to steel shipbuilding on a scale possibly rivalled only by one other similar concern in Canada. A considerable trade in structural steel has been developed with Japan.

—Photograph courtesy International Press.

Suggested Aids to Enable Wounded Ships to Keep Afloat-I*

By Chas. V. A. Eley

The statement has been made on many occasions during the past three years that the great conflict now raging is an engineers' war. No one, I think, will question that it is a war which opens up new fields in which engineers of all classes, whether naval or military, marine or civil, have been, and will be, called upon to give to our Empire the very best their brains are capable of, whether in new invention, construction, or in the use of appliances for the confounding of our enemies. Enabling wounded ships to keep afloat is highly desirable.

MARINE engineering and marine engineers are playing exceedingly important parts, both in the prosecution of the war and in the prevention of one of the main objects of our enemies being put into effect, viz., the starving of this country into submission. The Premier's motion in Parliament on Monday, October 29th, of this year testifies the great thankfulness of the country for the devotion to duty of those engaged in the mercantile marine service on their extremely hazardous work. The war, however, is not yet won, and there should be no "resting on our oars" at present. Marine engineers, to play their part to the best of their ability, have still arduous duties to perform in keeping their ships going and in the saving of their vessels from total destruction, if possible, when involved in disaster, just as much as the deck officers have to play their parts in dodging the mine or torpedo, shot and shell, submarine or aircraft.

Ship Saving Urgent

During the past three years the question of saving ships has come before the present generation with greater force probably than ever before, and the enemies with whom we are engaged in deadly conflict will endeavour to see to in that no stone shall be left unturned which might bring about our downfall by the loss of our ships of war and our merchant shipping—the finest the world has ever seen. Shall we permit them to do it, or shall we take every possible precaution to save our ships and ensure "safety at sea" to all who travel on our steamships? "Safety at sea" embraces a very wide field; ship design, ship construction, engineering, provision of rafts and boats, loading, navigating and working to prevent foundering or collision or running on sunken reefs or rocks, also the launching and lowering of boats and navigating them to land or to other vessels. Each of these subjects is so full of detail that they call for special treatment by the various departments directly concerned.

It is my intention to-night to deal with the engineering part only, and to see what are the possibilities of ensuring the flotation of a big ship, which I believe to be the best means of ensuring "safety at sea." There are three systems which I propose to deal with in the present paper, the three which I consider at the moment as being the best to come under discussion:—

1st. The Air Pressure System.
2nd. The "Brunton" System.
3rd. The "Eley" System.

Air Pressure System

Dealing firtsly with the air-pressure system, the principle involving the use of same is of a simple character. If a ship has a portion of her bottom torn away or is open to the sea on either side for a short vertical distance from the bottom, and the vessel has been arranged upon an air-tight construction, it is only necessary to pump air into the damaged compartments up to a pressure which will balance the head of water outside of the ship.

This air under pressure will force the water out of the ship down to the highest point of the damage, and the ship will retain nearly her normal buoyancy.

There are, however, at least two serious limitations to the use of this system.

1st. The damage to ships is more often than not too high up for its serviceable use.

2nd. The bulkheads and decks have to stand heavier strains than a flooded compartment would put upon them.

Limitations

In the case of the first drawback it could be illustrated by the case of a collision, or a ship subjected to shell fire, mine or torpedo. In either case the damage would be high in the vessel, and there would probably not be time to make the high damaged parts air-tight to enable air-pressure to be used effectively, and consequently this system would be absolutely useless.

In the second case, let us assume a vessel of 34 ft. draught and the deck above the damaged compartment 18 ft. above the keel, or 12 ft. above the tank top, the damage being just about the tank top. The air pressure necessary to keep back the water would have to be about 14 lbs. per square inch, which pressure the deck above would have to be able to stand; whereas with flooding, the pressure on the underside of that same deck would only be about 8 lbs. per square inch.

Taking into account the main facts that a compressed air system would only be suitable when the damage is low down in the ship, and the secondary facts mentioned, I consider it is not a suitable system to meet the various kinds of damage to ships, and could, therefore, not recommend its adoption as a permanent fitting in a vessel. although for raising a ship after sinking it is doubtless one of the best known systems.

The Brunton System

Next to the compressed air system in the order of my paper comes the "Brunton" system. For the benefit of those present who may not be acquainted with this system I will describe it in the inventor's own words.

It is hydraulically to divert the main circulating discharge water into a compartment at the extreme after end of the vessel, assuming that the damage is forward, thus giving the greatest moment and creating a head of water to any extent necessary. This also practically constitutes a dead weight. The effect of this is to overcome the head of water at the damaged end of the ship. Once this is done the water in the after compartment has — may I say? — got the upper hand. The ship will then begin the return movement to a level keel, and it will then be necessary to pump a certain amount of water out of the after-compartment, otherwise the vessel will continue changing trim, until she is trimmed by the stern: but with careful handling she can be brought to and retained on a level keel. and remain so for any period of time without necessitating the working of any pumps or any other gear. The inventor adds that he has made extensive experiments, which have been witnessed and thoroughly tested by many of the lading shipbuilding, naval architects and engineers of this country. There is no doubt that the arrangements suggested are simple (as is also the air-pressure system previously described), and, further, in certain classes of damages when the interior of the ship is open to the sea it might just be operative; but, like its predecessor. it is limited in its usefulness and, therefore cannot be recommnded for adoption for all kinds of damages a ship is likely to meet with in these days of fast travel and danger zones. As an example of this, Mr. Brunton wrote a letter to the editor of *Engineering* which was published in the issue dated November 26th. 1915, just after he had read and commended me on my outspoken book, a copy of which I trust each one of you will kindly accept to-night.

"Titanic" Disaster Cited

In that letter to *Engineering* he wrote that his method was the only one known

*Institute of Marine Engineers Paper, Nov. 13, 1917

which does not necessitate continued action, and would effectively bring a vessel into such a position that she could easily be taken any number of miles without the slightest risk of sinking. As an example, he wrote, let us consider a vessel with similar damage to that of the Titanic—that is, the forward compartments being broached, causing a considerable trim by the head, then I think you will agree that, instead of endeavouring to pump the water out of the damaged compartments, the easiest method of getting the water out is to use the method of raising the head, thereby causing the water to run out of the hole by which it came in. The method I propose for doing this is to hydraulically divert the main circulating discharge water into a compartment at the extreme after end of the vessel, etc., etc., as before described. Unfortunately, Mr. Brunton had evidently not read my book carefully before writing that letter, or he would have referred to some vessel other than the Titanic. As it was a direct challenge to the pumping system which I had advocated, I felt bound to take up the challenge on behalf of direct pumping, and on December 17th, 1915, *Engineering* published my letters on the same subject. This letter reads as follows:—

"In your issues of *Engineering*, dated November 19 and 26, you print letters on "Compressed Air for the Salving of Battleships" and "How to keep a Damaged Ship Afloat" respectively. As I cannot agree with the views of Mr. Brunton, the writer of the last mentioned letter, I will be glad if you will kindly give the same publicity to the following:—

Mr. Brunton stated: 'Assuming that a ship is damaged forward, there are three methods whereby the bows can be prevented from sinking.' I think the words "might be" should have been used, as I believe it would be very risky for a shipowner, or our Admiralty, to trust to either the first or third methods mentioned by Mr. Brunton, whilst the second method, which Mr. Brunton deprecates the use of, is, in my opinion, the very best system the shipowner could adopt.

Systems 1 and 2 Reviewed

Let us review the systems in the order given by Mr. Brunton:—

First System.—The admission of compressed air into damaged compartments, etc. I agree with both writers that such plant could not be serviceably used, because with any perforation high up in the flooded compartment the air would escape instead of forcing out the water.

Second System.—The pumping of the water out of the compartment as fast as it enters, thereby limiting the amount of water in the ship. This method is, in my opinion, the safest to adopt, because not only is pumping machinery of to-day almost immune from breakdown over long periods of time, but also because the greater part of the ship and its contents could be kept dry, and the vessel in most instances would not be suffering from either "heel" or trim.

Take the case of the Titanic, mentioned by Mr. Brunton, as an example. If Lord Mersey's report on the loss of that vessel is carefully read, it will be seen that the water entered through the damage at the rate of about 300 tons a minute; and if 30-inch suction pipes had been provided into the bilge from each of the 29-inch centrifugal circulating pumps, and the water-tight doors in the bulkheads had been left open, or means provided for passing the water through the double bottom to the pump suctions, such pumps could have put the whole of the water overboard as fast it entered, and they would have been doing only their ordinary daily work. Further, if the four electric lighting engines had been arranged with four 50-inch centrifugal pumps, these, with the circulating pumps, could have put overboard four times the quantity of water entering the Titanic without having to close a water-tight door in the ship. Electric pumps might have been provided if preferred. With pumps of either type no difficulty would arise, in my opinion, in getting the vessel into port from the middle of the Atlantic. In fact, as the damaged compartments would have been open for inspection, most of the damage could probably have been closed.

Third System Review

Third System.—The pumping of water into the stern to create a head which would have the effect of forcing the stern down and lifting the bow. This system is, in my opinion, very little better than system No. 1, owing to its narrow range of usefulness. I agree with Mr. Brunton "that any water above the damaged part of the ship should not be reckoned as weight." But it must not be forgotten "that the whole of the compartments open to the sea have lost buoyancy," and such part of the ship will have to be supported by the sound part of the vessel. In some types of damage this loss of buoyancy may be so extensive as to prevent salving a ship by such a system.

Let us look well into an exact case again, say the Titanic, as it will compare with what I have written under System 2, and will also keep to the case named by Mr. Brunton. I reproduce a drawing of the Titanic from Lord Mersey's report. The vessel's length was 852½ feet, the beam 92½ feet, and the weather deck 64 feet above the keel amidships. The displacement was 52 310 tons at 34 ft. 7 in. draught. Assuming that the immersed length of the vessel, say 825 ft., was constant, and the 34 ft. 7 in. draught was equal throughout its length, the average breadth of the parallelopipedon would be 64 ft. Therefore, at the time the Titanic struck the iceberg, as the draught was 32 ft. only, the displacement would be about 48 000 tons. When the loss of buoyancy occurred to 304 ft. of the vessel forward, the remaining 521 ft. had to carry the whole of the 48,000 tons; and assuming an even keel the draught would be increased to 48 ft., without reckoning anything for weight of water in the ship below the damage. Then if water was pumped into compartments aft to balance the loss of buoyancy and the 2,600 tons of water in the forward compartments below the damage, the four aftermost compartments would have to be filled up to the top of the water-tight bulkheads. By careful calculation I find that, allowing 20 per cent. for fittings, cargo, stores, machinery, etc., there would be 15,828 tons of water in such four compartments, and that it would just about balance the turning movement forward. It would, however, have put the vessel down to 64 ft. draught on an even keel, and the water would then have been 17 ft. above the line of reserve buoyancy; and, therefore, the vessel could not have been saved.

In Professor J. J. Welsh's paper, read before the North-East Coast Institution of Engineers and Shipbuilders at Newcastle on December 17, 1915, he dealt very extensively with the stability and trim of ships, dealing chiefly on the intermediate conditions which are likely to occur on a ship between the time of receiving the damage and the time at which the vessel is brought into trim theoretically. In a system like the Brunton for keeping a vessel afloat Professor Welsh's paper should be very carefully studied; but in a system of direct pumping, with pumps arranged for immediate action, and perhaps revolving slowly when in the danger zone, such watchfulness would not be necessary, as there would be no tendency for the vessel to loll.

Direct Pumping

Now the third system, which, having patented it, I will call the "Eley" System, deals mainly with direct pumping combined with central means of indicating the position and amount of damage, central means for operating the pumps and for levelling the water in the ship for keeping a level keel. Collision mats of a special character may also be used. In connection with the use of this special apparatus it is proposed to train certain of the ships' engineers to act as "Salvage Engineers," who would go to their station when the vessel was in trouble or when in a danger zone just in the same way as a "Gunner" would go to his station.

The salvage engineers' station would be a small compartment in the most invulnerable part of the ship, say about 12 or 15 ft. long by 6 or 7 ft. wide. On one of the longer sides, about 6 ft. above the deck, a flat sectional model of the ship would be placed with slides to operate vertically as indicators to show at a glance if water was building up in any compartment, and at what rate. Assuming transverse bulkheads only, just below each compartment of the model it is proposed to place the means for starting the pumps fitted in each respective compartment.

On the deck, close up to the side of the compartment where the model is placed. I would fix a system of levers, almost like the levers in a railway signal-box, one for each compartment of the ship. Such levers would control the opening and closing of the valves to be operated for levelling the water in the ship, preferably through the double bottom where such exists.

Let us suppose that a large vessel so fitted is just approaching a danger zone and the salvage engineer is at his post. Then, suppose the ship strikes a floating mine, doing immense damage, say, at the third compartment from the stem. The salvage engineer will see at once the indicator rising at the third compartment of the model. By means of the pump starter below the indicator he will at once start the pumps in the third compartment. He will see at a glance, however, that the pumps in such compartment will not be sufficient to handle the huge quantity of water coming into the ship. He will therefore pull over the lever at the same position (No. 3) and let the water travel throughout the length of the ship through the pipes or passages in the double bottom, whichever is provided. Then, if it is a 20 compartment ship, he will pull over No. 18 lever, and then start the pumps in No. 18 compartment. If he finds that the water is still gaining he can pull over levers No. 4 and No. 17 and start the pumps in those compartments, and so on, until he finds that he is pumping out water faster than it is entering the vessel. The ship's carpenter and crew could put into position specially constructed collision mats, or make good inside of the ship, or do both, as by keeping the vessel buoyant with pumping the inside of the compartment damaged would be open for the purpose of inspection, or to make good the damage temporarily.

Existing Pumping Arrangements

If the damage is too great for the pumps in the ship to deal with the whole quantity of water entering it, one, or perhaps two, damaged compartments even might be permitted to flood whilst the water was being kept out of all of the other compartments and the damage, except the damage in the two flooded compartments, "made good." Then the two flooded compartments could each be treated in the same way if possible. In any case, the vessel would not founder through consequential leakage, as many ships have done.

All kinds of ships are being sunk by floating mines, torpedoes and gunfire, and the time may soon arise when the shortage of ships will be critical. Such a condition of things must never be permitted if we can possibly help it, and one of the best ways to help it is to keep our ships afloat. And how do we know whether the German naval officials are not already looking after their vessels in the same way as I am suggesting? And if they are, what an advantage they will have over our own naval men.

Accommodating Pumping Installation

In connection with my scheme, I would suggest to the admiralty constructors that proper provision would not be difficult to make in new construction whereby the huge quantities of water required to be passed out of the ship could be. I would also suggest to the engineering department that the small amount of added weight would make very little difference in the draught of the ship, so would not interfere with its speed; and where such means exist in the vessel to save it from sinking the few inches less of freeboard would not matter. It would certainly not be necessary to leave out any of the guns or propelling machinery; therefore, the fighting powers of the vessel would not be impaired in any way. On the contrary, the fighting power of the ship would be increased owing to the fact that she could continue to fight even though badly damaged, instead of sinking, probably with her whole crew.

Existing Pumping Arrangements

Heretofore, auxiliary pumps have been arranged on board of ships to deal with incoming water, and these, in some cases, only in a half-hearted way. As an example of this, the Titanic had four centrifugal circulating pumps, with 29 in. inlets and outlets, and yet I believe only 18 in. suction pipes were led to the bilges for pumping water out of the ship. If she had been provided with 29 in. or 30 in. suctions into the bilges, and the incoming water had been permitted to flow through the ship to them and to the other pumps in the vessel, I believe she could have been saved. As battleships in war time have to put up with much greater damage than the Titanic received, and also merchant ships, for that matter, since the German edict went forth that all merchant ships it was possible to destroy were to be destroyed, it is useless to attempt to depend on the usual auxiliary pumps only for salving the vessel if torpedoed; consequently, it requires a bold scheme to deal with the matter effectively.

By the adoption of my scheme, engineers in ships will be able to watch complacently the water entering the vessel like a huge waterfall, and see the pumps forcing it out again as fast as it enters, and faster at first if necessary, whilst the ship's carpenter could be using all the available means in the ship to restrict the area of the incoming water until it was stopped altogether. What a marvellous change from the old style of eperyone scuttling out of the ship because it was "doomed." I trust that these remarks will not be treated lightly, as we are living in serious times; but that thinking men at the Admiralty and at the offices of the big steamship companies, and shipbuilders will take careful note of my suggestions and immediately act upon them if they see as much in them as I do. I will be willing to render any assistance that lies in my power to apply my suggestions.

In my book on this subject, I selected the Titanic as an example of a sinking liner, not merely because of her size, but because she was recently built, and was supposed to contain all that was good and necessary in the way of machinery. Also because of her special construction she was a simple case easily understood in the matter of sinking. Also because the evidence of the rate at which the incoming water entered the ship was very clear. I also selected the Victoria as an example of a battleship sinking because it has been so exhaustively dealt with by the Constructional Department of the Admiralty, and also because I knew practically every hole and corner in her from the top of the mast to the keel. The first news that I had of the H.M.S. Formidable being sunk gave very little information, and my thoughts immediately turned back to the sinking of the battleship H.M.S. Victoria, in 1893, after being rammed by the Camperdown during mimic warfare in the Mediterranean Sea; and I wonder if the Formidable had "turned turtle" in 11 minutes as the Victoria did, and if it was caused by the usual "trap" arrangement of water-tight doors, which enabled the incoming water to be nicely locked up in the head or stern of the vessel so that it could not possibly be pumped out by the auxiliary pumps in the centre of the ship, and as it gradually gathered weight the vessel became unstable, and finally turned over, or tipped up on end as the Titanic did, and then took a final plunge to the bottom of the sea in double quick time, so that the bulk of her crew had no chance of escaping the instant death awaiting them.

Water-Tight Compartments

You will probably think from the foregoing that I am not a lover of water-tight compartments in ships. I am strongly in favor of them being used if communication arrangements are employed in conjunction with them for balancing the ship, either by means of large valves and pipes or passages running from the fore to the after part of the ship or by means of doors or sluice-gates on the bulkheads themselves. Some water-tight decks are still worse if not operated correctly at the critical moment, and if the lowermost decks are water-tight ones they must be thoroughly understood by those responsible for the safety of the ship, or they would be much better riddled like a sieve. Can you conceive of anything worse than the water-tight scuttles on such a deck being closed, which I believe they are expected to be. What is likely to happen? If the vessel is rammed by another, or torpedoed above that lower deck, the water will build up on it, raising the centre of gravity, which is already high, to a dangerous point quickly; the vessel becomes unstable and turns over, whereas if the water were allowed to fall right into the bottom of the ship it would not only add to its stability, but the water would have a chance of reaching the pumps which are arranged for pumping from the bilge into the sea.

In the one case you would have the vessel turned over in about ten minutes, with the bulk of the crew locked inside of it; or if the injury was forward it might tip up on end, fill rapidly, and sink in about the same time. In the other case, the pumps would be dealing with the incoming water, the vessel would keep an even keel, and probably the vessel would be actually saved. In any case, she would sink so slowly that there would be ample time for everyone to escape if it was seen that the ship was doomed.

The only time when such a water-tight deck could be of service would be when the ship is perforated below such deck. Then by closing the horizontal water-tight scuttles the incoming water

would be prevented from rising above that deck. In no case should the watertight scuttles be closed in such a deck excepting in the circumstances named.

The sinking of the Formidable immediately set me thinking how she could be raised, just as the loss of the Victoria did 22 years earlier; and whilst cogitating on a certain scheme which in those earlier days occurred to me, and which was still fresh in my mind, the thought came to me, Why not prevent ships sinking? It would be easier than raising them. After giving some thought to the possibilities of doing this, wading through certain hydraulic formulas and making calculations, in which entered H.M.S. Victoria, Titanic, H.M.S. Hogue, Cressy and Aboukir, H.M.S. Formidable, H.M.S. Tiger, and H.M.S. Queen Elizabeth, I came to the conclusion that it is quite possible to save a big ship from sinking even though she was badly holed by a torpedo or mine.

The figures obtained in these researches were a revelation to me, and will no doubt also surprise not a few of my hearers when they see them. For instance, when the Titanic was lost we had estimates given to us of the number of foot tons striking force due to the weight and speed of such an immense vessel. We also were told that with such an immense striking force the whole of the bottom was ripped open like a sardine tin would be with a tin opener. Then, when Lord Mersey's Report was published, it was seen that the damage was not in the bottom, but on the starboard side, 10 ft. above the keel, and that the damage, which extended for about 300 ft. of the vessel's length, was so great that the ship was doomed the moment that it struck. Even this makes the damage still look enormous and quite beyond the powers of a pumping plant to deal with.

I have, however, shown by careful calculation how the total perforation could not have amounted to more than between five square feet and six square feet area; which means an average width of only a quarter of an inch throughout the 300 ft. length of the damage. By this I do not mean that there was just a slot cut in the vessel's side 300 ft. long by a quarter of an inch wide, but the equivalent of it. The damage was no doubt very irregular, being at its worst in No. 2 and No. 3 holds, about 150 ft. from the head of the ship. Ice, being of a brittle character, was kinder to the vessel than a granite rock would have been, and it no doubt only perforated the side of the ship in places along the 300 ft. of damage. I merely mention the Titanic at this stage as an illustration of how the damage received by a ship may be somewhat magnified without actual calculation is entered into.

Of course, the idea of preventing vessels sinking is by no means new. It has been engaging the attention of boat and ship builders no doubt ever since the earliest times; but as ships have increased in size, weight and speed, the shipowners and shipbuilders' responsibilities have likewise increased, until to-day all the ingenuity of man is called into play to provide satisfactory means to prevent the loss of life and property, which may be in one ship equal to that of a small town. That such provision has not been effectively made is instanced by the number of maritime casualties recorded annually.

Losses Through Insufficiency of Pumping Machinery

I believe many vessels founder through having insufficient pumping machinery on board to deal with the incoming water, due to the ship straining in a storm. In other cases, I believe vessels founder through want of knowledge on the part of engineers, either through only having just joined their vessel or through not having studied the question of balancing their vessel and forming a proper course as to how to act in cases of emergency in the matter of closing or opening communicating doors of watertight compartments. In other cases, again, I believe vessels have been lost which had on board sufficient power in their auxiliary pumps to save the ship, but owing to the bad arrangement of same it was impossible for them to be used. As a rule, however, the auxiliary pumps on a ship are not sufficient to deal with the incoming water caused by collision or by torpedo, but require to be supplemented with a complete system of pumps capable of starting together at a moment's notice, whereby the whole of the forces existing in the ship for the purpose of propulsion could be utilized for propelling water from the vessel when open to the sea, or such part of those forces as any particular condition calls for. Probably the same idea has been in the minds of others, but as it does not appear to have been adopted, the ground is evidently quite new for practical application.

Problems to Be Solved

Many problems presented themselves to me, the most important being:—

1. What description of pump would best fulfil the purpose required, having regard to efficiency, space necessary, weight and ease of installation?

2. Would it be advisable to sacrifice efficiency to obtain decrease of weight and space required?

3. Would it be wise to sacrifice efficiency so as to be able to eliminate the possibility of not being able to operate the pumps owing to breakdown of the main engines?

4. Or would it be best to hold on to efficiency, combined with an increase of weight, and have the pumps quite independent of the main engines, even at the sacrifice of weight in other matters connected with the ship; or even if it meant carrying a little less fuel, especially as the means of coaling vessels at sea or getting oil fuel aboard have improved greatly during the past few years?

5. How should the water dealt with be passed out of the ship?

I will endeavor to deal with each of these problems in my own way; not that I expect to lay down any hard and fast rule thereby, because the problems will be sure to crop up again at the time of application, and varying conditions will call for different decisions in specific cases.

Pump Types

Dealing now with these problems in bulk, I consider that the best kind of pump to use for the work would be involute centrifugal single stage pumps; but in certain cases the expulsor form of steam pump, or even steam jet pumps might be considered, as an installation of the latter would be better than no installation at all. In round figures, the comparative pumping capacities of these pumps would be about as follows, in gallons pumped per pound weight of steam available:—

Centrifugal pumps, 168 gallons per lb. of steam against a 40 ft. head.

Pulsometer pumps, 15 gallons per lb. of steam against a 40 ft. head.

Steam jet pumps, 4 gallons per lb. of steam against a 40 ft. head.

This would mean in a vessel like the Olympic, whose boilers are capable of evaporating, I should say, about 750,000 pounds of steam per hour, the possibility of doing the following duty:—

	Gallons per hour
Centrifugal pumps	126,360,000
Pulsometer pumps	11,250,000
Steam jet pumps	3,000,000

respectively.

The numbers and weights would work out roughly as follows with ordinary commercial pumps:—

234 20 in. centrifugal pumps, weighing 600 tons, pumps only.

150 9 in. pulsometer pumps, weighing 375 tons, pumps only.

300 3 in. steam jet pumps, weighing 10 tons, pumps only.

And the price about as follows:—

234 20 in. centrifugal pumps, £35,000, pumps only.

150 9 in. pulsometer pumps, £20,250, pumps only.

300 3 in. steam jet pumps, £1,500, pumps only.

The weights and prices of the centrifugal pumps and the pulsometers could be, however, considerably reduced by making the bulkhead plates form one side of specially constructed pumps, probably to two-thirds of the weights and amounts stated above. Other special constructions which I have in mind might reduce the weight even still further. To the weights and costs given must be added extras for any pipes and valves required, fixing, and for the starting arrangements.

LACHINE CANAL 1917 SEASON

MORE than 70,000 tons of grain and miscellaneous cargo were carried by all vessels going through the Lachine Canal during the 1917 season above what they carried in 1916. In 1917 there were 738 more passengers, 22 more vessels, 265,411 more tons of coal, 8,309 more cords of pulpwood bound up to Canadian ports, 24,693 more tons of pulp, 85,800 more sacks of flour, 165 more trips of vessels with cargo, and 38,704 more tons of sand than there had been in 1916.

On the other side of the slate one has

to note that in grain alone 1917 shows the total for grain cargoes to be 5,818,100 bushels under the total of grain carried in 1916, 35 fewer pleasure craft, 59,557 cords less of pulpwood up to American ports, no pulp to Canadian ports, decreases in the amounts of eggs, butter, cheese and apples carried, and 1, 289,400 feet board measure less of lumber coming down from Ottawa for United States ports by American canal boats than in 1916.

The first grain vessel which came down the canal in 1917 was the steamer Advance, from Port Colborne, on May 3, with a cargo of 40,173 bushels corn. The last grain vessel down was the steamer Steelton, from Fort William, on December 6, with a cargo of 88,406 bushels barley. The last lake freighter westbound was the steamer Calgarian, on December 5. Navigation on the canal opened April 25, one day later than in 1916, and closed on December 10, five days earlier than in 1916. Thus in 1917 there were six days less of navigation.

The canal office was open night and day, Sundays and holidays included, throughout the whole of the season of navigation. Navigation was extremely difficult during the last two weeks of the season on account of the ice formed in the canal by the cold weather prevailing. For some time navigation was kept open by harbor tugs, aided by American tugs on their way out to sea. Several vessels are still bound up by ice conditions in the canals and are prevented from reaching their destination until the opening of the 1918 season.

Big Increase in Wheat

So far as grain was concerned, there was an increase of 2,267,517 bushels of wheat, the total brought down being 13,201,732 bushels, and a decrease in every other kind of grain. The comparative figures for 1916 and 1917 in the grains showing a decrease are as follows: Corn, 992,193 and 178,071, decrease 814,122 bushels; oats, 10,067,032 and 4,752,649, decrease 5,314,383 bushels; barley, 2,502,914 and 1,090,977, decrease 1,411,937 bushels; rye, 377,500 and no bushels; flaxseed, 294,598 and 126,923, decrease 167,675 bushels; and the total grain carried for the seasons of 1916 and 1917 respectively, 25,168,452 and 19,350,352, decrease 5.818,100 bushels.

The decrease in the tonnage of grain carried was more than made up by coal, as only 1,674,899 tons of coal were carried in 1916, and 1,940,310 tons this season, or 265,411 tons more in 1917.

The comparative statistics with regard to pulpwood for 1916 and 1917 respectively are as follows: To Canadian ports, 16,116 and 24,425, increase 8,309 cords; and to American ports, 125,734 and 66,177, decrease, 59,577 cords. With regard to pulp the 1916 and 1917 figures are: To Canadian ports, 2,000 and no tons, decrease, 2,000 tons; to American ports, 60,117 and 86,810, increase, 26,693 tons; total, 62,117 and 86,810; increase, 24,693 tons.

No flour was shipped in 1916, and 85,800 sacks in 1917. Comparative figures for 1916 and 1917 in other kinds of produce are: Eggs, 12,622 and 8,570; decrease, 4,052 cases; butter, 4,529 and 4,058; decrease, 471 packages; cheese, 223,943 and 221,885; decrease, 2,058 boxes; and apples, 9,090 and 8,629; decrease, 461 barrels.

Canal's Big Business

In 1917 vessels made 7,936 trips through the canal, an increase over the previous year of 357. Deducting from this the difference between the 2,851 voyages made light for return cargoes by vessels in 1916 and the 3,043 voyages in 1917, one finds that vessels carrying cargoes made 4,893 trips in 1917, as against 4,728 in 1916. These trips were made by 607 vessels of 294,773 tons burthen, an increase over 1916 of 22 vessels and 33,987 tons. The total combined tonnage of all the trips made through the canal amounted to 4.145,836, an increase above 1916 of 144.663 tons. The cargo tonnage was 3.335.943, which was 70.921 tons more than in 1916. Passengers carried numbered 69,910, or 738 more than in the previous season. Permits were given to 126 pleasure craft to pass through the canal.

Statistics of the vessels using the canal in 1916 and 1917 respectively have been analyzed as follows: 144 Canadian steam vessels of 84,050 tons burthen, and 145 of 79,677 tons this season; 91 American steam vessels of 95.356 tons in 1916, and 148 of 144.698 tons burthen in 1917; 194 Canadian barges, scows, etc., of 54.308 tons burthen in 1916, and 186 of 55 803 in 1917; 27 American barges of 13 666 tons burthen in 1916, and only 3 of 1,755 in 1917; and 129 American canal boats of 13.406 tons, and 125 of 12,840 tons in 1917.

Ten Canadian steam vessels of a tonnage amounting to 4 096 and 115 American steam vessels of 125.199 tons passed through the canal to the harbor, and did not return during the season. This leaves 482 vessels of 165.478 net tons, which operated through the canal continually. The heaviest traffic was, therefore, down the canal through the season.

The lumber brought in 1917 from Ottawa for United States ports by American canal boats totalled 37.442 tons, or 22 465 000 feet board measure, as against 39,591 tons, or 23.754.000 feet board measure in 1916. There has, therefore, been a decrease of 1,289,400 feet board measure.

Sand carried up the canal amounted to 53 951 tons, an increase of 30 990, and down the canal to 72.268 tons, an increase of 7,714 tons. The total sand carried through the canal amounted to 126.219 tons, an increase of 38,704 tons on 1916.

SUBMARINE BOAT CORPORATION BUILDING STEEL SHIPS

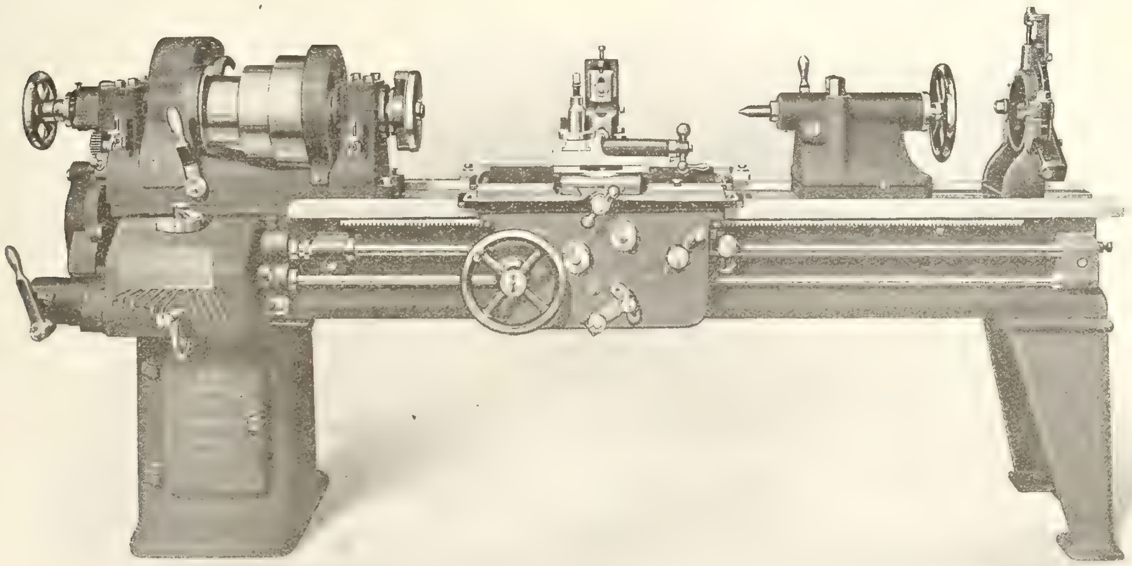
THE keel of the first of the steel ships in the Submarine Boat Corporation's yard was laid on December 20 by Edward M. Hurley, chairman of the Shipping Board. The programme calls for completion of 150 steel ships in Newark yards. The Newark Bay plant is one of the largest in the United States and was over 90 per cent. completed in 67 days. It will be possible, officials stated, to have 28 ships under construction at one time in the yards.

The Shipping Board announced that with the conclusion of the building facilities at the yard finished ships will be turned out from that plant with clock-like precision. Experience that the company has gained in the past in reproducing submarines and chasers in large numbers will count heavily in the speed of production and completion of ships now under way. With the plant going at full speed 15,000 workmen will be employed and officials estimate that fully 30,000 more workmen will be engaged at eastern industrial centres in the work of fabricating materials for the new vessels.

CONCRETE KEEL-BLOCK

ONE of the results of the war conditions at present prevailing is that shipbuilders and ship repairers are experiencing great difficulty in securing the necessary wooden blocks for insertion under the keel of vessels under construction and under repair. With this difficulty it was natural that some attempts would be made to devise a keel-block made of substitute materials, and the most successful efforts in this direction have been made by the Ayrshire Dockyard Co., Ltd., of Irvine, Scotland, who have devised a structure of iron, concrete, whinstone and sand, or other suitable material. The advantages claimed from this structure may be briefly summarized as giving great facility and cheapness in construction, combined with great strength and durability.

With regard to the facility of construction, all that is required is a wooden box of similar shape or design to that of the ordinary keel block, so as to contain the proper mixture of cement, iron, sand, etc., and it is found that one of these blocks can be made by one man in an hour, and after being allowed to harden for several days it is ready for use, whilst as regards cheapness one of these arched heel-blocks can be constructed for about one-third the cost of wood. Even allowing for the present high price of cement it is estimated that three arched heel blocks would not exceed in cost that of one set of wooden blocks of similar height. Particular attention has been given to securing the maximum strength with the greatest lightness of weight and one of the earliest made blocks has been tested to a weight of 90 tons, without showing any signs of weakness. For specially heavy loads two or more blocks can be placed side by side, but for ordinary shipbuilding purposes the single block will be found to be quite sufficient. By altering the composition these blocks may be made "half strength," although the size and shape is retained. In this case the weight of the block is merely reduced, and is in consequence more easily handled. A very useful feature of these blocks is that they will not deteriorate nor are they affected by water, and with care will last for a great number of years.



ASSOCIATION AND PERSONAL

A Monthly Record of Current Association News and of Individuals Who Have Been More or Less Prominent in Marine Circles

Capt. Demers, Wreck Commissioner, who is sitting on the Mont Blanc-Imo inquiry at Halifax, has instructions to proceed to Prince Edward Island to make an inquiry into a marine mishap there.

Lt. J. K. L. Ross, of the R.N.C.V.R., has been promoted to the rank of commander for the splendid services he has rendered to the Department of the Naval Service and for his generosity in many other ways.

Captain Arthur C. May, one of the best known vessel masters on the Great Lakes, died at his home in Port Huron on December 11 after an illness of five months. He was fifty-eight years old, and had resided in Port Huron twenty-eight years. During the great storm of November, 1913, Capt. May, then master of the steamer Hawgood, saved his ship and crew by beaching it north of Point Edward. The vessel escaped with but little damage, and the captain was highly complimented by his company for his action.

James Carruthers, president the Canada Steamship Lines, was on December 11 made the recipient of a silver cigar humidor at the hands of the departmental heads of the company on the eve of his departure for an extended holiday in the southern states. J. W. Norcross, vice-president and managing director, made the presentation and in doing so expressed for himself and his co-workers the esteem in which their president was held. Roy Wolvin, president of the Montreal Transportation Co., went south with Mr. Carruthers.

Lieut. Commander J. A. M. Murray, one of the C.P.R. fleet captains, was instantly killed in the explosion at Halifax. Capt. Murray was for about 15 years in the Elder-Dempster West African trade, and also in the West India line. When the C.P.R. took over the Elder-Dempster line, Captain Murray went with the ships and served under the C.P.R. until four years ago, when he became Harbor Master of Quebec. When the war broke out, he was sent by the Canadian Government in the winter to Halifax. Later he was at Sydney, and last summer returned to Halifax, where he was put in the Imperial service. He was in command of the Lake Manitoba for a long time before taking the command of the Empress of Britain.

Peter Denny, a notable figure in the shipbuilding and marine engineering world, passed away suddenly during the month at his residence, Crosslet House, Dumbarton, Scotland.

He was one of the best-known and popular men in Clyde shipbuilding circles, and was associated with his brothers and his cousin in the direction of the famous firm of shipbuilders and engineers at Dumbarton. Mr. Denny, a son of the late Peter Denny, himself an eminent shipbuilder, was trained as an engineer, and it was to that branch of business that he devoted most of his attention, the great reputation of the firm being in a considerable measure due to his activity and ability. Outside of his professional work he was closely identified with many public services in his native town of Dumbarton. He served in the town council, and was promoted to the magistracy; he also sat in Dumbarton County Council, and held the position of hon. sheriff substitute at Dumbarton. A patron of art, he was at the founding of the local School of Science and Art. He was also a patron of football, golf, and bowling. He was also a gentleman of many fine qualities, a capable platform speaker, the life and soul of a social gathering, and an out-and-out Dumbartonian. His death is a great loss to the town and district. Mr. Denny, who is survived by his widow, was in his 64th year.

Additional Cargo Winch Orders.—The Imperial Munitions Board has increased its order with Hutchinson Bros. & Co., Victoria, B.C., for the building of cargo winches. The original contract called for the construction of forty-four, and this has now been increased to sixty-five. The winches are to be installed in wood vessels being built for the Imperial Munitions Board. The Victoria Machinery Depot is proceeding with the construction of twelve boilers asked for by the Munitions Board. The boilers are of the Howden forced draught type. Thirty propellers are being made for the Munitions Board by Yarrows, Ltd., at Esquimalt.

LICENSED PILOTS

ST. LAWRENCE RIVER

Captain Walter Collins, 43 Main Street, Kingston, Ont.; Captain M. McDonald, River Hotel, Kingston, Ont.; Captain Charles J. Martin, 13 Balaclava Street, Kingston, Ont.; Captain T. J. Murphy, 11 William Street, Kingston, Ont.

ST. LAWRENCE RIVER, BAY OF QUINTE, AND MURRAY CANAL

Captain James Murray, 106 Clergy Street, Kingston, Ont.; Capt. James H. Martin, 259 Johnston Street, Kingston, Ont.; John Corkery, 17 Rideau Street, Kingston, Ont.; Captain Daniel H. Mills, 272 University Avenue, Kingston, Ont.

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Alf. Charbonneau, Sorel, Que., and J. Scott, Halifax, N.S., Grand Auditors.

1917 Directory of Subordinate Councils, National Association of Marine Engineers.

Name	No.	President.	Address.	Secretary.	Address.
Toronto,	1	Arch. McLaren,	324 Shaw Street	E. A. Prince.	108 Chester Ave.
St. John,	2	W. L. Hurder,	209 Douglas Avenue	G. T. G. Blewett,	36 Murray St.
Collingwood,	3	John Osburn,	Collingwood, Ont.	Robert McQuade,	Collingwood, Ont.
Kingston,	4	Joseph W. Kennedy,	395 Johnston Street	James Gillie,	101 Clergy St.
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Vancouver,	7	Isaac N. Kendall	319 11th St. E., Vanc.	E. Read,	Room 10-12, Jones Bldg.
Levis,	8	Michael Latulippe,	Lauzon, Levis, Que.	J. E. Belanger,	Bienville, Levis, Que.
Sorel,	9	Nap. Beaudoin,	Sorel, Que.	Alf. Charbonneau,	Box 204, Sorel, Que.
Owen Sound,	10	John W. McLeod	570 4th Ave.	J. Nicoll,	714 4th Ave. East
Windsor,	11	Alex. McDonald,	28 Crawford Ave.	Neil Maitland,	221 London St. W.
Midland,	12	Geo. McDonald	Midland, Ont.	Roy N. Smith,	Box 178
Halifax,	13	Robert Blair	29 Parrsboro Street	Chas. E. Pearce,	Portland St., Dartmouth, N.S.
Sault Ste. Marie,	14	Charles H. Innes,	27 Euclid Road	Geo. S. Biggar,	43 Grosvenor Ave.
[illegible]	15	J. A. Rowe	176 King Street	Chas. Cumming,	27 Easton St.
[illegible]	16	H. W. Cross,	76 Ambrose St	E. L. Williams	142 Secord St., Port Arthur, Ont.

MARINE NEWS FROM EVERY SOURCE

To Winter at Fort William.—Orders have been received by the Lake Shippers' Clearance Association to have the following boats lie up at Fort William for the winter:—D. R. Hanna, E. L. Sellwood and Robinson.

"Western Star" Salvaged.—The wrecked steamer Western Star recently salvaged from the Georgian Bay has gone into dry dock at Collingwood to be repaired and overhauled so as to be ready for the opening of the 1918 season of navigation.

Japanese Shipyards Busy.—Nine ships, aggregating 45,115 tons, were launched during September in Japanese yards, constituting a record. These are part of programme for building shipping amounting to 300,000 tons during the fiscal year ending April, 1918, of which thirty-five vessels aggregating 154,727 tons have already been launched.

New B. C. Port.—A new port has been opened in British Columbia for merchant vessels on Smith Sound. The Canadian hydrographic office has issued a statement that the new port has been surveyed and charted and will be officially known as Margaret Bay. It lies between Smith and Boswell inlets.

Kingston, Ont.—The record of a number of trawlers being built to the order of the Department of Naval Service was launched by the Kingston Shipbuilding Company this month. The boat was christened T. R.-18 by Miss Patricia Sowards, of this city, daughter of J. F. Sowards, vice-president of the company.

Steamer "Lehigh" Raised.—The Donnelly Salvage & Wrecking Co. have succeeded in raising the steamer Lehigh, sunk in the Welland Canal recently when it collided with a bridge, damaging her port bow. Her cargo of coal is being sold to parties at Welland, and repairs to the steamer will be made there. The Lehigh will go to Cuba in the spring.

C. G. S. "Simcoe" Lost.—All hope for the safety of the crew of the Canadian Government steamer Simcoe, which was reported sinking on the night of December 7 off Magdalen Islands, has been abandoned. The last message picked up from the vessel was to the effect that the life-boats were being cleared. Naval patrol boats have been unable to find any wreckage or trace of the crew.

To Winter at Trenton.—A fleet of boats will again winter in Trenton. The steam barges James W. Follette, Cabotia and Robert R. Rhodes of the Canada Shipping Co. arrived some little time ago. Then the John B. Ketcham, a steel boat, came up from Kingston, also the tug Florence, barge Frank D. Ewen and steamer Rideau Queen of the Trent Navigation Co., the tug Margaret Hackett and barges Zapotec and Gladys H. Extensive repairs, amounting to $75,000, will be made during the winter.

Record Ore Movement.—A record for the month of November in the movement of ore from the Lake Superior district was established last month, when the cargo-carriers on the lakes loaded 7,331,804 tons, according to figures just issued. This is an increase over November a year ago of 1,616,351 tons, and brings the season's total to December 1 up to slightly more than 61,500,000 tons. The season's total, however, is approximately 2,000,000 tons less than for the same period last year.

Enlarge British Shipyards.—Arrangements have been made for the construction of an additional thirty-three slips to existing shipyards, according to Dr. Macnamara in the British House of Commons. Altogether an addition of from fifty to sixty slips will be made to existing yards. The number of slips in the new National yards will be between thirty and thirty-six. The sites for three of the new National yards are at Chepstow, Beachley and Portbury, and the construction of them is in progress. It is intended that slips for the laying down of keels will be available in from three to four months, and the first vessel will be launched in October or November, 1918.

Must Anchor Near Bank.—Vessels desiring to anchor in River St. Clair must do so as near the bank as possible. This War Department order was issued on December 4 through the office of Colonel F. W. Allstaetter of the United States Engineers headquarters in Detroit. The order has special reference to anchorage near the head of St. Clair River in the vicinity of Port Huron. The order reads: —"When vessels have occasion to anchor in channels connecting the Great Lakes they shall select for such anchorage deep water as near the bank as possible, leaving the largest practicable clear channel for passage of other vessels. In no case shall they lie so as to endanger traffic."

Suffer Hardships Following Wreck.—Captain Kolseth, commander of the Vancouver fishing steamer Manhattan, wrecked one mile west of Lituya Bay, accompanied by most of the crew of fifty-five men, reached Vancouver on Dec. 4, from Juneau, after a series of adventures. The Manhattan, with 90,000 pounds of halibut aboard, went on a reef in a blinding snow-storm. The men hurried to the dories and put to sea without food or water. Great hardships were encountered in the 48-mile row to Cape Spencer. The crew of one dory were chased off an island by bears, and another crew landed and made a meal from the herring caught in one of their nets. Finally the sailors were picked up by the steamer Mariposa, which was herself subsequently wrecked in northern waters. The Manhattan is a total loss, and could not be replaced for $125,000.

Soo Canals in November.—The generally favorable weather prevailing during November reveals itself in increased tonnage carried through the canals, as shown by the statistical report issued by the U. S. Engineers' Office on December 4; 11,154,508 tons freight were handled during the month. Iron ore shows an increase of 1,319,213 tons over the same period last year. One million eight thousand six hundred and sixty-six more tons of coal were carried west towards the close of the season this year than last. Passenger traffic shows a remarkable falling off. Last November 426 passengers braved the lakes, while during the month just passed only 242 are recorded. During the month 2,772 vessel passages were made, a total quantity of freight of 1,706,078 tons was locked through the Canadian canal and 9,448,430 through the American.

Grain Shipments From Head of Lakes.—In spite of various conditions which were expected to militate against the movement of grain from Port Arthur and Fort William, the season of 1917 proved to be the second best in the history of the twin ports. In this connection a grand total of 207,721,403 bushels was shipped. The record year was in 1916, with a total of 253,969,500 bushels. The total in 1915 was 201,793,915. From September 1 to December 14 the official close of navigation this year, grain shipped in Canadian vessels totalled 44,378,021 bushels, and in United States vessels, 54,319,405, a grand total for that end season period of 98,697,426. For the entire season of 1917 Canadian vessels carried from these ports 102,314,652, and American vessels 105,406,751 bushels. Receipts for the crop year ending August 31, 1917, which practically represents the 1916 crop, were 224,438,196 bushels. The above figures do not include a small amount of off grade and screenings shipped.

Big Harbors Needed When War Over.—Improvement in sea transportation was discussed at the London, England, Chamber of Commerce, on Dec. 5, when Lord d'Abernon emphasized the need of bigger ships of great speed after the war. He suggested the government should start the provision of big harbors. About $20,000,000 would provide for vessels of 38-foot draught at practically all the leading harbors from Great Britain to the furthest dominion. The report of the Dominion Royal Commission just issued gives memoranda and tables as to harbors throughout the Empire.

New Ferry Line.—The city council of Windsor, Ont., on December 3 by a vote of six to four adopted a resolution giving the use of water lots at the foot of Brock Street to a syndicate of Toronto men headed by Charles Miller for the purpose of operating an international ferry line between Windsor and Detroit. The new company must organize within two years, or if it fails to do so the water lots will revert to the corporation. The plan for the new ferry line was fathered by Ald. F. L. Howell, who informed the councillors that the company intended to expend from half a million to a million dollars in the purchase of new modern ferryboats able to carry the increasing foot traffic as well as the automobiles. The boats are to be "double enders" similar to those used on the Hudson River at New York.

Seamen's Union Urges Recruiting.—Impatient over what they term the delay of Great Lakes vessel owners in carrying out plans to recruit seamen to man America's new merchant fleet, the International Seamen's Union in annual convention on December 11 adopted a resolution appealing to the Shipping Board to issue a call for men and to conduct a recruiting campaign within thirty days, "regardless of any refusal or neglect on the part of ship-owners to join in the call." The appeal also recommends that the Board require vessel owners temporarily to increase the size of their crews, thereby rapidly adding to the number of available trained men. The resolution also proposed that provision be made for training young men and boys on merchant vessels, and the Shipping Board is asked to require vessel owners to provide such additional quarters as may be necessary. Another resolution calls upon Congress to enact a general Compensation Act for seamen.

SHIPBUILDING IN THE U. S.

A TOTAL of seven million tons of shipping will be completed in the United States before the end of 1918, it is confidently predicted by officials of the Shipping Board. The wooden ship programme, which has been much belittled, will result in 100 ships of 3,500 tons each—a total of 350,000 tons—being completed by April 1. By that time there will have been completed not less than one million tons of steel ships, including those commandeered on the stocks.

Meantime, there will have been added to the Atlantic shipping a fleet 135 vessels from the Great Lakes, which will be got out before navigation on the lakes closes. This is nearly 400,000 tons of shipping which, so far as the carrying of troops and supplies abroad is concerned, is just as good as new construction.

In January the fabricating plants will begin their output of completed ships, their first launchings being in March. A heavy penalty attaches to delay. The three fabricating plants combined will turn out 15 completed ships every two weeks, or a little over a boat a day. One-third of these boats will be 5,000 tons each, one-third 7,500 tons each, and one-third 9,000 tons each.

"HUSH" SHIPS DESCRIBED

A. ROUSSEAU, the naval critic of the "Temps," who returned recently to Paris from visiting the Grand Fleet, has been permitted by the British Admiralty (says a "Times" Paris telegram) to give French readers the first description of the famous "hush" boats, about which the authorities have succeeded in maintaining hitherto a profound secrecy.

"We were passing in front of ships of unusual aspect, specially constructed craft for war purposes, when certain of these vessels caught our attention, especially by their outline and dimensions. They were very long, with immense decks fore and aft. They appeared to lie low on the water. In the middle of the vessel rises a very squat central castle, at the extremities of which are heavy artillery turrets for two guns of biggest calibre.

"The secondary artillery, the calibre of which is the same on all vessels of the same type, is at the limit of the average of small artillery. The stem of these craft is tapered more like the stem of a yacht than that of a battleship, and has certainly been determined in order to realize very high speed, and as a matter of fact these vessels are very swift, much faster than the fleet test of pre-war cruisers.

"These craft—we may call them battle cruisers—are of two types, or rather dimensions, for their elements of power are, we believe, the same except as regards protection. These vessels have been created since the war. Inspired by the lessons of the war, they were begun in 1915, and have been in service twelve months, an admirable result of the organization of labor in British dockyards.

"Other vessels of the kind are under construction, their dimensions being yet more considerable. We were received on two of these vessels, and visited the fighting quarters, blockhouse, look-out station for submarines, a turret with its enormous guns, which fire two shells a minute, weigh 96 tons, and throw a shell weighing 1,947 pounds.

"Everything is organized to have fire control in one and the same hand and the laying by one and the same eye. The system invented by Sir Percy Scott a few years ago has made progress; heavy artillery and secondary artillery are no longer autonomous. Everything acts under one and the same direction. It is a truly remarkable system, and one which beyond all doubt has produced highly satisfactory results. Its installations on the new ships show that it has stood the test.

"These ships are capable of surprise action against which the enemy cannot guard himself, and their speed is a guarantee against a torpedo; but nevertheless they are fitted with devices to neutralize the explosion as far as possible. They are proof of the confidence of the British Navy in the powerful surface vessel, capable of heavy hitting, the only one which is able to assure mastery of the seas."

MORE FUEL OIL FOR STEAMERS

AN important change which has been comparatively lost sight of owing to the stress of war conditions is the increasing use of crude oil as fuel for steamships. Without a great deal of publicity having been given to the fact, a not unimportant portion of the American merchant marine has been turned into oil burners. The navies of the world, of course, have been using oil as fuel much longer than the merchant services. In this connection it may be noted that at a recent conference held at Washington between representatives of the American and British governments. Standard Oil officials and the Shipping Board, an ample supply of oil for the British navy was assured.

The chief advantages claimed for oil as fuel are a saving of bunker space in the ship and a saving of dead-weight. Up to comparatively recent years the drawback has been the price of oil, but with the unprecedented enhancement in the price of coal which war conditions have brought with them the economic opportunity to use oil has presented itself. Speaking generally the increase in the Texan, Mexican, and Californian oil supply which has taken place during recent years has made possible a greater use of oil for generation of steam on ships. Hitherto oil was usually too valuable to be used in ships furnaces.

Particularly on the Pacific Coast and in trade with the Orient has the war promoted the use of oil as fuel on ships, the source of supply in the Gulf region and California being relatively near at hand.

Five steamers now in course of construction for the New York-Valparaiso service are to be oil burners. Eighty per cent. of the Standard Oil steamers now afloat are equipped as oil burners. The Southern Pacific Railway, which has oil fields of its own, has been the leader in this country in the use of oil fuel for locomotive engines. In 1915 the company had 1,927 oil-burning locomotives out of a total of 2,046 engines. The Southern Pacific is also using oil as fuel for its steamers to a very considerable extent.

Newcastle, N.B.—The International Shipbuilding Corporation has commenced the erection of an extensive plant for wooden vessels at Nordin, on the Miramichi River. The first keel will be laid shortly.

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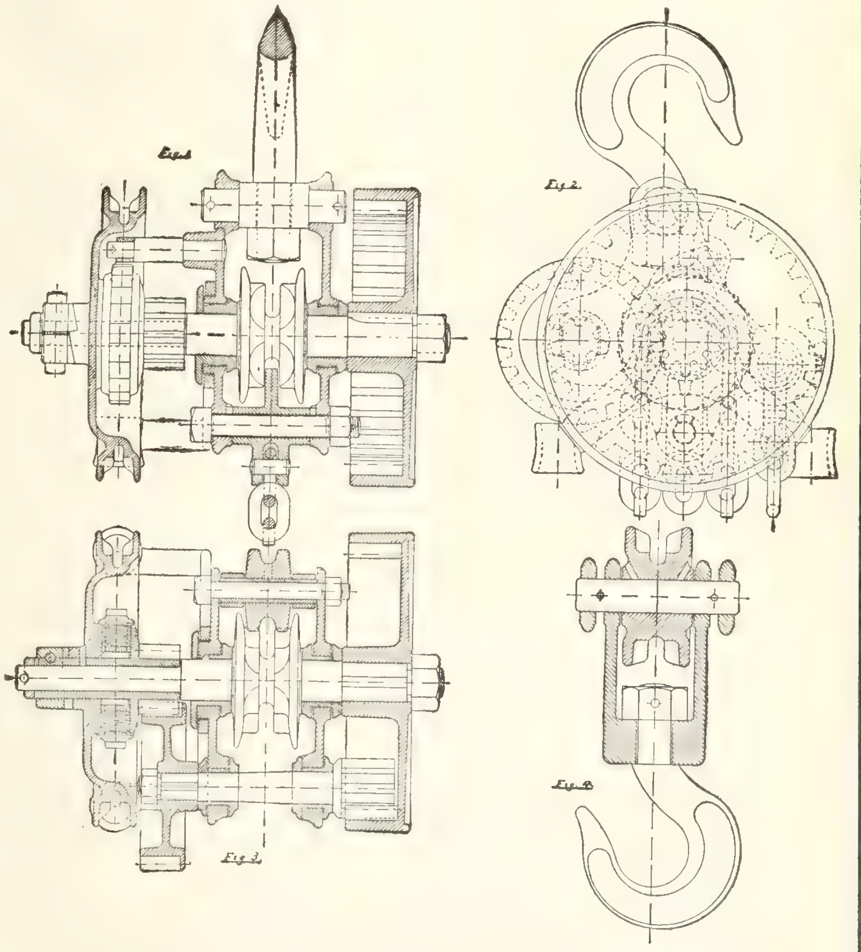

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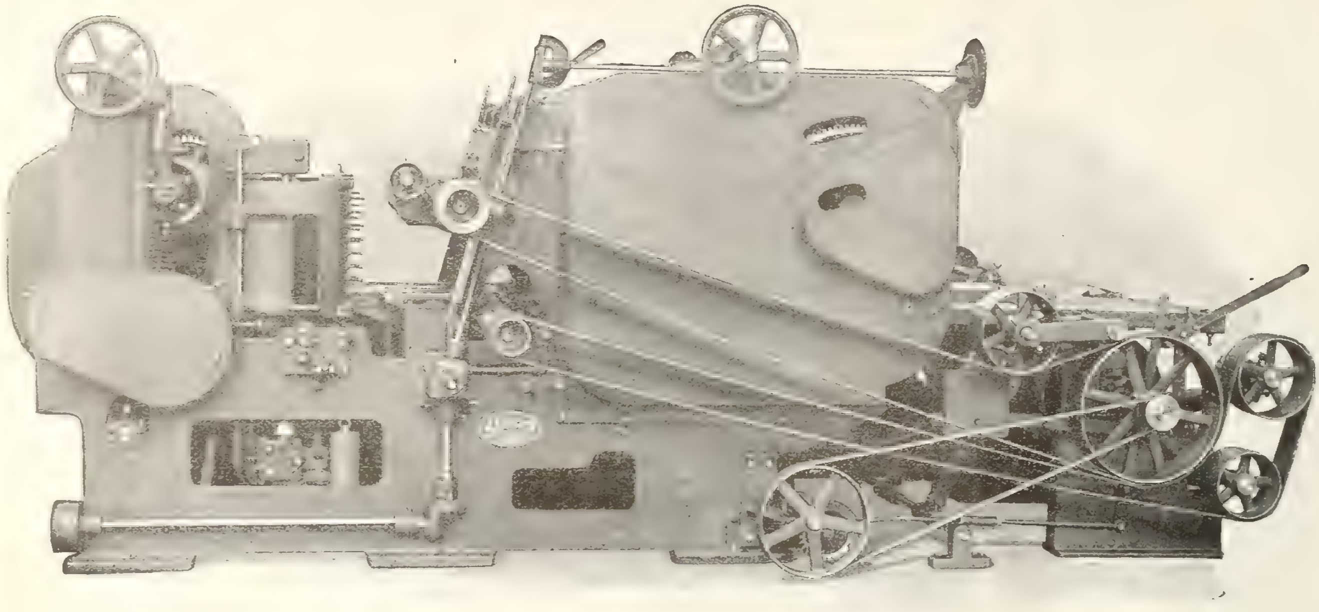

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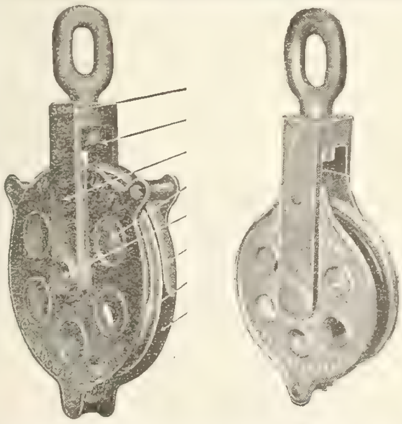

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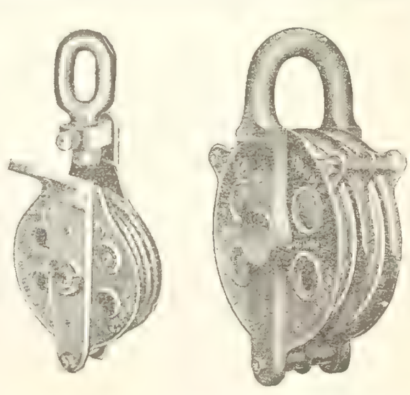

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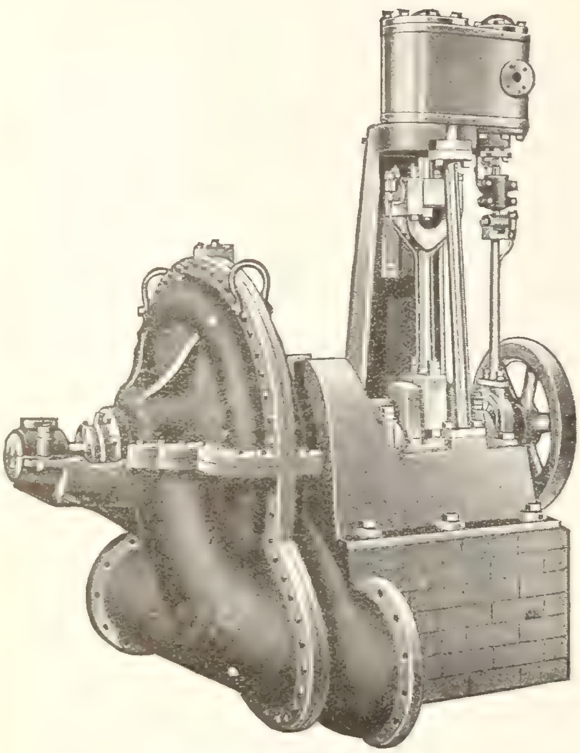

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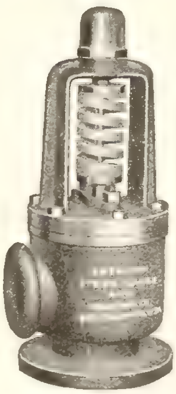

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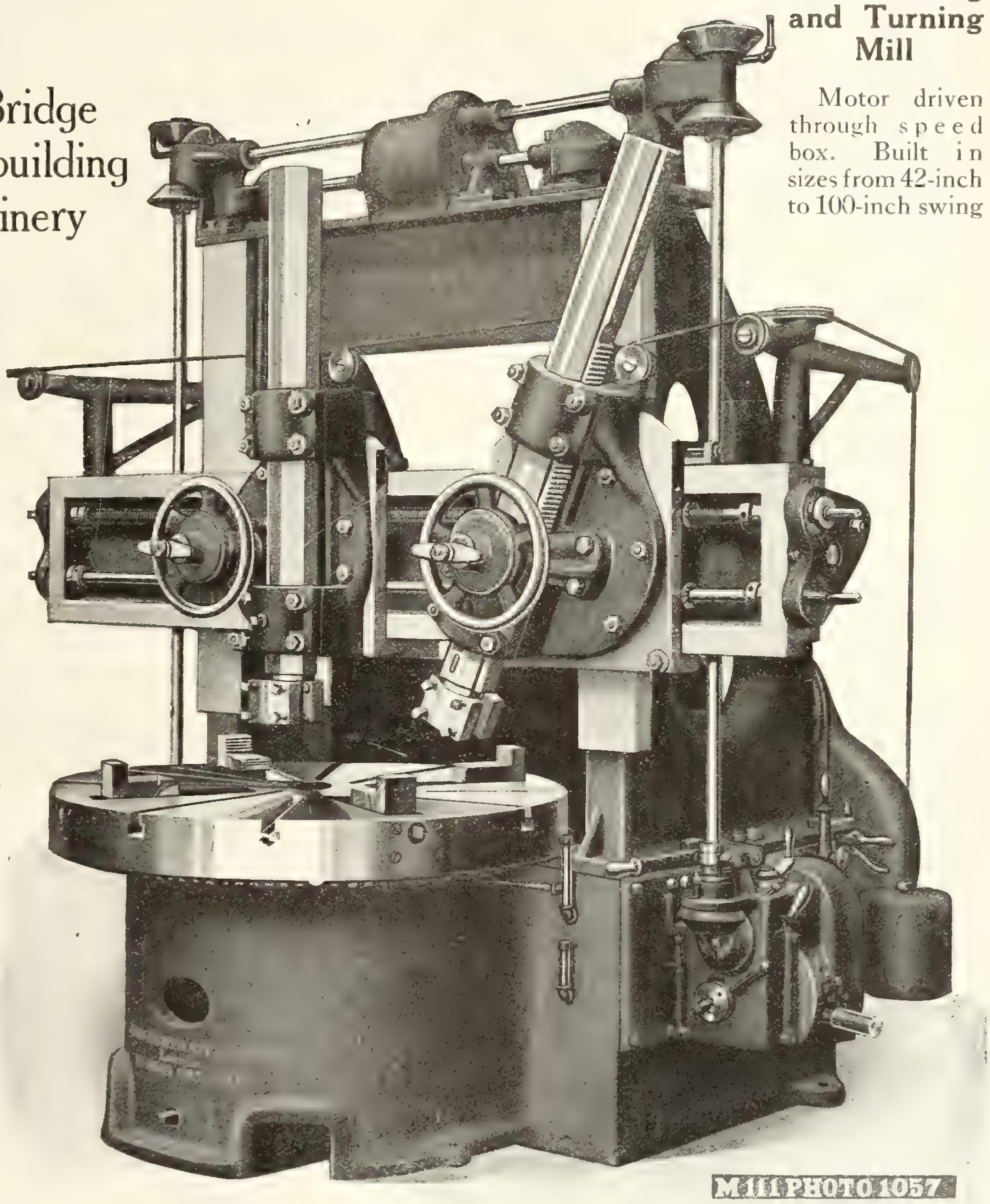

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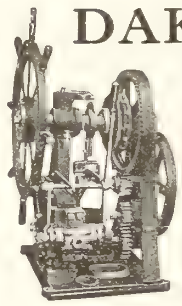

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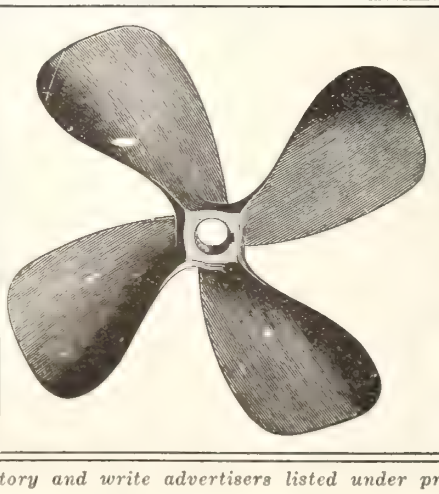

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Babcock & Wilcox, Ltd., Montreal, Que.

BARS, IRON AND STEEL
Topping Brothers, New York, N.Y.

BEARINGS, BRASS
Empire Mfg. Co., London, Ont.
Murray & Fraser, New Glasgow, N.S.
United Brass & Lead Co., Toronto, Ont.

BELLS, SHIPS, ENGINE ROOM, ETC.
Aikenhead Hardware, Ltd., Toronto, Ont.
Cory & Son, Inc., Chas., New York, N.Y.
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.

BELTING, LEATHER
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.

BIBBS, COMPRESSION
Empire Mfg. Co., London, Ont.

BINNACLES
Morrison Brass Mfg. Co., James, Toronto, Ont.
Topping Brothers, New York, N.Y.

BLOCKS, CARGO, HEEL AND TACKLE
Aikenhead Hardware, Ltd., Toronto, Ont.
Loveridge, Ltd., Docks, Cardiff, Wales.
Topping Brothers, New York, N.Y.

BLOWERS, TURBO-
Can. Allis-Chalmers, Toronto, Ont.
Mason Regulator & Engin. Co., Montreal, Que.

BOILER FEED PUMPS
Can. Allis-Chalmers, Toronto, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

BOILER FITTINGS
Empire Mfg. Co., London, Ont.
McAvity & Sons Ltd., T., St. John, N.B.

BOILERS, MARINE
Babcock & Wilcox, Ltd., Montreal, Que.
Can. Allis-Chalmers, Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Doxford & Sons, William, Sunderland, England.
Goldie & McCulloch, Ltd., Galt, Ont.
Hall Engineering Works, Montreal, Que.
Jenckes Machine Co., St. Catharines, Ont.
Mason Regulator & Engin. Co., Montreal, Que.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
National Shipbuilding Co., Goderich, Ont.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.
Polson Iron Works, Toronto, Ontario.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

BOOKS, TECHNICAL, MARINE
MacLean Publishing Co., Toronto, Ont.

BOLTS
Topping Brothers, New York, N.Y.
Wilkinson & Kompass, Hamilton, Ont.

BROKER
Fuller, Louis, N., 163 Hollis St., Halifax, N.S.
Page & Jones, Mobile, Ala., U.S.A.

BUCKETS, CLAMSHELL
Beatty & Sons, Welland, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.

BUCKETS, COALING
Beatty & Sons, Welland, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.

CAPSTANS
Advance Mach. & Welding Co., Montreal, Que.
Dake Engine Co., Grand Haven, Mich.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

CALKING TOOLS
Empire Mfg. Co., London, Ont.
Topping Brothers, New York, N.Y.

CALKING TOOLS, ELECTRIC
Aikenhead Hardware, Ltd., Toronto, Ont.

CALKING TOOLS, PNEUMATIC
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

CALORIFIERS
Low & Sons, Ltd., Archibald, Glasgow, Scotland

CASTINGS
Collingwood Shipbuilding Co., Collingwood, Ont.
Jenckes Machine Co., St. Catharines, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.
The John McDougall Caledonian Iron Works Co., Montreal, Que.

CASTINGS, ALUMINUM
Empire Mfg. Co., London, Ont.
United Brass & Lead Co., Toronto, Ont.

CASTINGS, BRASS
Booth-Coulter Copper & Brass Co., Toronto, Ont.
Empire Mfg. Co., London, Ont.
McAvity & Sons Ltd., T., St. John, N.B.
United Brass & Lead Co., Toronto, Ont.

CEMENT SOLUTION
Can. Bitumastic Enamels Co., Toronto, Ont.

CHAINS
Aikenhead Hardware, Ltd., Toronto, Ont.
Kearfott Engineering Co., New York, N.Y.
Topping Brothers, New York, N.Y.

CHANDLERY, SHIP
Leckie, Ltd., John, Toronto, Ont.

CHUTES, COAL
Can. Allis-Chalmers, Toronto, Ont.

CLAMPS
Topping Brothers, New York, N.Y.

CLOCKS
American Steam Gauge & Valve Mfg. Co. Boston, Mass.
Morrison Brass Mfg. Co., James, Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

COAL
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

COCKS, BILGE, DISCHARGE, INDICATOR, ETC.
McAvity & Sons Ltd., T., St. John, N.B
Morrison Brass Mfg. Co., James, Toronto, Ont.

COCKS, BASIN
Empire Mfg. Co., London, Ont.

COMPRESSORS, AIR
Can. Allis-Chalmers, Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Canadian Ingersoll-Rand Co., Sherbrooke, Que.
Jenckes Machine Co., St. Catharines, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

CONCRETE MIXERS
St. Clair Bros., Galt, Ontario.
The John McDougall Caledonian Iron Works Co., Montreal, Que.

CONDENSERS
Can. Allis-Chalmers, Toronto, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kearfott Engineering Co., New York, N.Y.
Morris Machine Works, Baldwinsville, N.Y.
Smart-Turner Mach. Co., Hamilton, Ont.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

CONVEYORS, ASH, COAL
Babcock & Wilcox, Ltd., Montreal, Que.

COPING MACHINES
Bertram & Sons, Ltd., John, Dundas, Ont.

COPPERSMITHS
Booth-Coulter Copper & Brass Co., Toronto, Ont.

COPPER TUBES, SHEETS AND RODS
Dominion Copper Products Co., Ltd., Montreal, Que.

COTTON, CALKING
Wilson & Co., Wm. C., Toronto, Canada.

COVERS, CANVAS, FOR HATCHES, LIFE-BOATS, ETC.
Leckie, Ltd., John, Toronto, Ont.

COUNTERS, REVOLUTION
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

CRANES
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ont.

CRANES, ELECTRIC
Babcock & Wilcox, Ltd., Montreal, Que.
Smart-Turner Mach. Co., Ha[illegible]

CRANES, GANTRY
Smart-Turner Mach. Co., Hamilton, Ont.

DAVITS, BOAT
Babcock & Wilcox, Ltd., Montreal, Que.

DERRICKS
Aikenhead Hardware, Ltd., Toronto, Ont.
Dake Engine Co., Grand Haven, Mich.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.

DISTILLERS
Kearfott Engineering Co., New York, N.Y.

DREDGES
Collingwood Shipbuilding Co., Collingwood, Ont.
Norbom Engineering Co., Philadelphia, Pa.
Polson Iron Works, Toronto.

DRILLS, AIR
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

DRILLS, TWIST
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

DRILLS, ELECTRIC
Aikenhead Hardware, Ltd., Toronto, Ont.
Wilkinson & Kompass, Hamilton, Ont.

DRY DOCKS
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Doxford & Sons, William, Sunderland, England.
Georgian Bay Shipbuilding & Wrecking Co., Midland, Ont.
Montreal Dry Docks & Shipbuilding Co., Montreal
Muir Bros. Dry Dock Co., Port Dalhousie, Ont.
National Shipbuilding Co., Goderich, Ont.
Polson Iron Works, Toronto, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.
Yarrows, Limited, Victoria, B.C.

ECONOMIZERS, FUEL
Babcock & Wilcox, Ltd., Montreal, Que.

EJECTORS
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.

ELECTRO-PLATING
United Brass & Lead Co., Toronto, Ont.

ELEVATING MACHINERY
Goldie & McCulloch, Ltd., Galt, Ont.

ENAMEL
Can. Bitumastic Enamels Co., Toronto, Ont.

ENGINES, DIESEL
Can. Allis-Chalmers, Toronto, Ont.

ENGINES, HOISTING
Advance Mach. & Welding Co., Montreal, Que.
Can. Allis-Chalmers, Toronto, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Marsh & Henthorn, Ltd., Belleville, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

ENGINE, INTERNAL COMBUSTION
Doxford & Sons, William, Sunderland, England.

ENGINES, MARINE
Bolinders Co., New York, N.Y.
Can. Allis-Chalmers, Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Can. Vickers, Ltd., Montreal, Que.
Doxford & Sons, William, Sunderland, England.
Goldie & McCulloch, Ltd., Galt, Ont.
Iron Works, Ltd., Owen Sound, Ont.
Mason Regulator & Engin. Co., Montreal, Que.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
Murray & Fraser, New Glasgow, N.S.
National Shipbuilding Co., Goderich, Ont.
Norbom Engineering Co., Philadelphia, Pa.
Polson Iron Works, Toronto, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Trout Co., H. G., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

ENGINES, STEERING
Dake Engine Co., Grand Haven, Mich.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

EVAPORATORS
Kearfott Engineering Co., New York, N.Y.
Mason Regulator & Engin. Co., Montreal, Que.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.

EXTRACTORS, GREASE
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

FANS
Aikenhead Hardware, Ltd., Toronto, Ont.
Empire Mfg. Co., London, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

FENDERS, ROPE
Leckie, Ltd., John, Toronto, Ont.
Wilson & Co., Wm. C., Toronto, Canada.

FERRULES, CONDENSER
Booth-Coulter Copper & Brass Co., Toronto, Ont.

FERRO-MANGANESE
Mitchells, Ltd., Glasgow, Scotland.

FILES
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Toronto, Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

FIRE BRICKS
Mitchells, Ltd., Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

FILTERS, FEED WATER
Mason Regulator & Engin. Co., Montreal, Que.

FITTINGS, MOTOR BOAT
Empire Mfg. Co., London, Ont.
Murray & Fraser, New Glasgow, N.S.

FIXTURES, ELECTRIC
Can. General Electric Co., Toronto, Ont.
Cory & Son, Inc., Chas., New York, N.Y.

FORGES
Aikenhead Hardware, Ltd., Toronto, Ont.

FLUORSPAR
Mitchells, Ltd., Glasgow, Scotland.

FORGINGS, ALL KINDS
Aikenhead Hardware, Ltd., Toronto, Ont.
Collingwood Shipbuilding Co., Collingwood, Ont.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.
St. Clair Bros., Galt, Ont.

GAUGES, RECORDING
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Empire Mfg. Co., London, Ont.

GAUGES, WATER, PRESSURE, COMPOUND AND VACUUM
Aikenhead Hardware, Ltd., Toronto, Ont.
Babcock & Wilcox, Ltd., Montreal, Que.
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.

GENERATORS, STEAM TURBO
Can. General Electric Co., Toronto, Ont.

GENERATORS AND CONVERTORS
Can. General Electric Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.

GRINDERS, ELECTRIC
Wilkinson & Kompass, Hamilton, Ont.

GRINDERS, PNEUMATIC
Can. Ingersoll-Rand Co. Sherbrooke, Que.

HAMMERS, DROP AND BELT DRIVEN
Beaudry & Co., Boston, Mass.

HAMMERS, MOTOR DRIVEN
Beaudry & Co., Boston, Mass.

HAMMERS, NAIL MACHINE
Beaudry & Co., Boston, Mass.
United Hammer Co., Boston, Mass.

HAMMERS, PNEUMATIC
Barr, H. Edsil, Palace Bldg., Erie, Pa.

HAMMERS, POWER
United Hammer Co., Boston, Mass.

HEATING EQUIPMENT
Empire Mfg. Co., London, Ont.
Low & Sons, Ltd., Archibald, Glasgow, Scotland

HEATERS, FEED, WATER
Babcock & Wilcox, Ltd., Montreal, Que.
Can. Allis-Chalmers, Toronto, Ont.
Kearfott Engineering Co., New York, N.Y.
Mason Regulator & Engin. Co., Montreal, Que.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.

HOISTS, ASH
Beatty & Sons, Welland, Ont.
St. Clair Bros., Galt, Ont.

HOISTS, CHAIN
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Dake Engine Co., Grand Haven, Mich.
Topping Brothers, New York, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

HOISTS, CARGO, MOVING, ETC.
Dake Engine Co., Grand Haven, Mich.
Jenckes Mach. Co., Ltd., Sherbrooke, Que.

HOISTING MACHINERY
Beatty & Sons, Welland, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

HYDRAULIC MACHINERY
The John McDougall Caledonian Iron Works Co., Montreal, Que.

INDICATORS, ENGINE
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Cory & Son, Inc., Chas., New York, N.Y.

INDICATORS, SPEED
Aikenhead Hardware, Ltd., Toronto, Ont.
Cory & Son, Inc., Chas., New York, N.Y.

INJECTORS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Allis-Chalmers, Toronto, Ont.
Empire Mfg. Co., London, Ont.
Morrison Brass Mfg. Co., James, Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

INSTRUMENTS, NAUTICAL
Leckie, Ltd., John, Toronto, Ont.

JOINTS, BALL SLIP
Norbom Engineering Co., Philadelphia, Pa.

INSURANCE, MARINE
Toronto Insurance & Vessel Agency, Toronto, Ont.

LAMPS, ARC, INCANDESCENT
Can General Electric Co., Toronto, Ont.

LATHES
Foss & Hill Machinery Co., Montreal, Que.
Bertram & Sons, Ltd., John, Dundas, Ont.

LIFEBUOYS, BELTS AND PRESERVERS
Fosbery Co., Barking, Essex, Eng.

LIFE BOAT EQUIPMENT
Leckie, Ltd., John, Toronto, Ont.

LIFE JACKETS
Leckie, Ltd., John, Toronto, Ont.

LIGHTS, ALL KINDS
Can. Fairbanks-Morse Co., Montreal, Que.
Morrison Brass Mfg. Co., James, Toronto, Ont.

LIGHTS, SIDE, PORT
McAvity & Sons Ltd., T., St. John, N.B.

LIGHTING SETS
Can. Fairbanks-Morse Co., Montreal.
Cory & Son, Inc., Chas., New York, N.Y.
Kearfott Engineering Co., New York, N.Y.
Williams Machinery Co., A. R., Toronto, Ont
Wilson & Co., Wm. C., Toronto, Canada.

LUBRICATORS
Empire Mfg. Co., London, Ont.

MACHINISTS
Hyde Engineering Works, Montreal, Que.

MACHINE AND FORGE WORK
Thor Iron Works, Toronto, Ont.

METERS, STEAM, WATER
Can. Allis-Chalmers, Toronto, Ont.

MOTORS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. General Electric Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ont.

NET LIFTERS
Dake Engine Co., Grand Haven, Mich.
Leckie, Ltd., John, Toronto, Ont.

NOZZLES, ALL KINDS
Empire Mfg. Co., London, Ont.

NUTS
Wilkinson & Kompass, Hamilton, Ont.

OIL CUPS
Empire Mfg. Co., London, Ont.
Murray & Fraser, New Glasgow, N.S.

OIL SEPARATORS
Can. Allis-Chalmers, Toronto, Ont.

OAKUM
Leckie, Ltd., John, Toronto, Ont.

OXY-ACETLYENE OUTFITS
Can. Fairbanks-Morse Co., Montreal, Que.
McAvity & Sons Ltd., T., St. John, N.B.
Williams Machinery Co., A. R., Toronto, Ont.

PAINT
Ault & Wiborg Co. of Can., Ltd., Toronto, Ont.
Brandram-Henderson, Ltd., Montreal, Que.
Can. Bitumastic Enamels, Ltd., Toronto, Ont.,

PACKING, AMMONIA
Can. B. K. Morton Co., Montreal.
France Packing Co., Philadelphia, Pa.

PACKING, MARINE
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Montreal.
France Packing Co., Philadelphia, Pa.

PACKING, METALLIC
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. B. K. Morton Co., Montreal.
France Packing Co., Philadelphia, Pa.

PACKING, STEAM
Aikenhead Hardware, Ltd., Toronto, Ont.
France Packing Co., Philadelphia, Pa.

PINIONS, CUT
Hamilton Gear & Machine Co., Toronto, Ont.

PIPE, LAPWELD, CAST IRON, RIVETED
Empire Mfg. Co., London, Ont.
Norbom Engineering Co., Philadelphia, Pa.

PITCH, PINE
Wilson & Co., Wm. C., Toronto, Canada.

PLANERS
Bertram & Sons, Ltd., John, Dundas, Ont.

PLANERS, STANDARD AND ROTARY
Preston Woodworking Machinery Co., Preston, Ont.
Yates Mach. Co., P. B., Hamilton, Ont.

PLATE PUNCH TABLES
Norbom Engineering Co., Philadelphia, Pa.

PLATE WORK
Jenckes Machine Co., St. Catharines, Ont.

PLUMBING EQUIPMENT
Low & Sons, Ltd., Archibald, Glasgow, Scotland.
Empire Mfg. Co., London, Ont.

PROPELLOR BLADES, BRONZE
Empire Mfg. Co., London, Ont.
Murray & Fraser, New Glasgow, N.S.
Yarrows, Limited, Victoria, B.C.

PROPELLER WHEELS
Kennedy & Sons, Wm., Owen Sound, Ont.
Trout Co., H. G., Buffalo, N.Y.

PIPING, COPPER
Booth-Coulter Copper & Brass Co., Toronto, Ont.

PIPING, STEAM
Babcock & Wilcox, Ltd., Montreal, Que.

PULLEYS
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS
Can. Fairbanks-Morse Co., Montreal, Que.
Goldie & McCulloch, Ltd., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMP, AIR
Can. Ingersoll-Rand Co. Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, CIRCULATING
Kingsford Fdy. & Mach. Works, Oswego, N.Y.
Morris Machine Works, Baldwinsville, N.Y.

PUMPS, CENTRIFUGAL
Can. Allis-Chalmers, Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.
Kearfott Engineering Co., New York, N.Y.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Norbom Engineering Co., Philadelphia, Pa.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, FEED WATER
Can. Allis-Chalmers, Toronto, Ont.
Weir Ltd., G. & J., Cathcart, Glasgow, Scotland.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, HAND AND POWER
Aikenhead Hardware, Ltd., Toronto, Ont.
Smart-Turner Mach. Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PUMPS, HIGH PRESSURE
Canadian Ingersoll-Rand Co., Sherbrooke, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

PUMPS, STEAM TURBO
Can. Allis-Chalmers, Toronto, Ont.

PUMPING MACHINES
Norbom Engineering Co., Philadelphia, Pa.

PUNCHES
Bertram & Sons, Ltd., John, Dundas, Ont.

PUNCHES, SINGLE, DOUBLE AND MULTIPLE
Norbom Engineering Co., Philadelphia, Pa.

PURIFIERS, WATER
Babcock & Wilcox, Ltd., Montreal, Que.
Can. Allis-Chalmers, Toronto, Ont.

RADIO ENGINEERS
Cutting & Washington, Inc., Cambridge, Mass.

RADIATORS, STEAM, ELECTRIC
Empire Mfg. Co., London, Ont.
Low & Sons, Ltd., Archibald, Glasgow, Scotland.

RECEIVERS, AIR
Can. Allis-Chalmers, Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

REGULATORS, FEED WATER
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

REGULATORS, PRESSURE
Mason Regulator & Engin. Co., Montreal, Que.

REPAIRS, MARINE
Corbet Foundry & Mach. Co., Owen Sound, Ont.
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Georgian Bay Shipbuilding & Wrecking Co., Midland, Ont.
Hyde Engineering Works, Montreal, Que.
Iron Works, Ltd., Owen Sound, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
Muir Bros. Dry Dock Co., Port Dalhousie, Ont.
National Shipbuilding Co., Goderich, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Yarrow, Limited, Victoria, B.C.

RIGGING, WIRE ROPE
Leckie, Ltd., John, Toronto, Ont.

RIVETS
Wilkinson & Kompass, Hamilton, Ont.

RIVETERS, PNEUMATIC
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

ROLLS, STRAIGHTENING, BENDING
Bertram & Sons, Ltd., John, Dundas, Ont.

ROPE BLOCKS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Que.
Thor Iron Works, Toronto, Ont.

ROPE
Leckie, Ltd., John, Toronto, Ont.

SAWS, BAND
Preston Woodworking Machinery Co., Preston, Ont.

SAW MILL MACHINERY
Preston Woodworking Machinery Co., Preston, Ont.
Yates Machine Co., P. B., Hamilton, Ont.

SCALES, BOILERS, ENGINES
Can. Fairbanks-Morse Co., Montreal, Que.

SCOWS
Collingwood Shipbuilding Co., Collingwood, Ont.
Polson Iron Works, Toronto, Ont.

SHAPES
Topping Brothers, New York, N.Y.

SEPARATORS, OIL, STEAM
Mason Regulator & Engin. Co., Montreal, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

SHAFTING
Wilkinson & Kompass, Hamilton, Ont.

SHAFTING, BRONZE
Empire Mfg. Co., London, Ont.
Murray & Fraser, New Glasgow, N.B.

SHEARS
Bertram & Sons, Ltd., John, Dundas, Ont.
Norbom Engineering Co., Philadelphia, Pa.

SHIPBUILDING TOOLS
Aikenhead Hardware, Ltd., Toronto, Ont.
Can. Ingersoll-Rand Co. Sherbrooke, Que.

SHIPS, BUILDERS OF
Can. Vickers, Ltd., Montreal, Que.
Collingwood Shipbuilding Co., Collingwood, Ont.
Doxford & Sons, William, Sunderland, England.
Georgian Bay Shipbuilding & Wrecking Co., Midland, Ont.
Montreal Dry Docks & Shipbuilding Co., Montreal, Que.
National Shipbuilding Co., Goderich, Ont.
Polson Iron Works, Toronto, Ont.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.
Yarrows, Limited, Victoria, B.C.

SHIP BROKERS
Page & Jones, Mobile, Ala.

SHIP PLATES
Nova Scotia Steel & Coal Co., New Glasgow, N.S.
Topping Brothers, New York, N.Y.

SHIPS' TELEGRAPHS
Cory & Son, Inc., Chas., New York, N.Y.
Morrison Brass Mfg. Co., James, Toronto, Ont.

SLEDGES
Wilkinson & Kompass, Hamilton, Ont.

SPECIAL MACHINERY
Smart-Turner Mach. Co., Hamilton, Ont.

SPIKES
Topping Brothers, New York, N.Y.

STANDPIPES
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Thor Iron Works, Toronto, Ont.

STAYBOLTS, FLEXIBLE
Can. Allis-Chalmers, Toronto, Ont.

STEAMSHIP AGENTS
Page & Jones, Mobile, Ala.

STEAM SEPARATORS
Can. Allis-Chalmers, Toronto, Ont.

STEAM SPECIALTIES
Can. Fairbanks-Morse Co., Montreal, Que.
Empire Mfg. Co., London, Ont.

STEAM TRAPS
Aikenhead Hardware, Ltd., Toronto, Ont.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Empire Mfg. Co., London, Ont.
Mason Regulator & Engin. Co., Montreal, Que.
Smart-Turner Mach. Co., Hamilton, Ont.

STEEL, HIGH SPEED
Can. B. K. Morton Co., Toronto, Montreal.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.
Wilkinson & Kompass, Hamilton, Ont.

STEEL WORK, STRUCTURAL
Babcock & Wilcox, Ltd., Montreal, Que.

STOKERS, MECHANICAL
Babcock & Wilcox, Ltd., Montreal, Que.

SUPERHEATERS, STEAM
Babcock & Wilcox, Ltd., Montreal, Que.

TANKS, STEEL
Jenckes Mach. Co., Ltd., Sherbrooke, Que.
The John McDougall Caledonian Iron Works Co., Montreal, Que.
Port Arthur Shipbuilding Co., Port Arthur, Ont.
Thor Iron Works, Toronto, Ont.

TANKS
Corbet Foundry & Mach. Co., Owen Sound, Ont.
Goldie & McCulloch, Ltd., Galt, Ont.
Jenckes Machine Co., Ltd., Sherbrooke, Que.
Marsh & Henthorn, Ltd., Belleville, Ont.

TELEPHONES, MARINE
Cory & Son, Inc., Chas., New York, N.Y.

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TROLLEYS
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TUBES, BOILER
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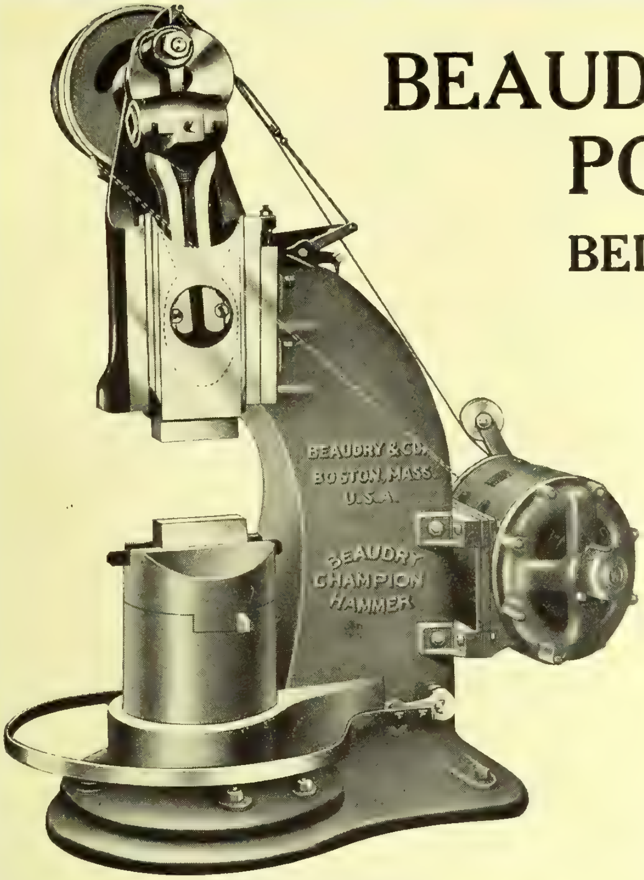

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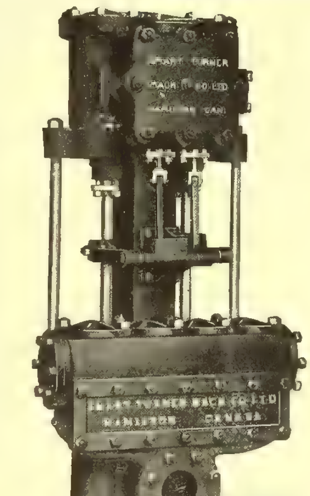

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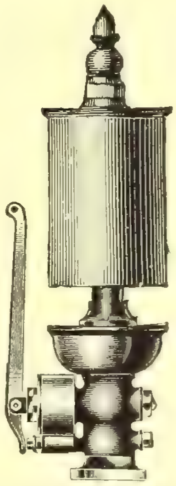

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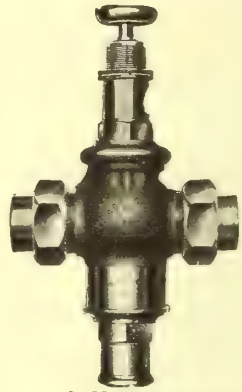

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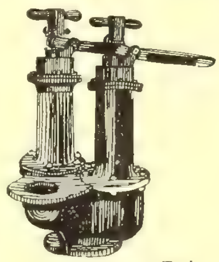

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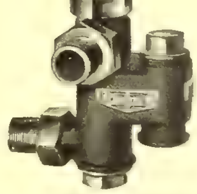

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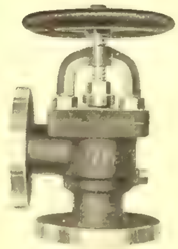

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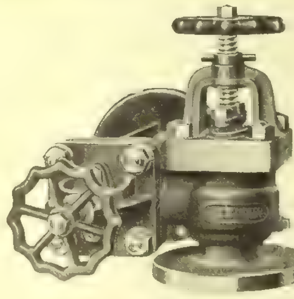

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